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*Control of*  
**HOUSEHOLD INSECTS**  
*and Related Pests*

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In order that the information in our publications may be more intelligible it is sometimes necessary to use trade names of products or equipment rather than complicated descriptive or chemical identifications. In so doing it is unavoidable in some cases that similar products which are on the market under other trade names may not be cited. No endorsement of named products is intended, nor is criticism implied of similar products which are not mentioned.

# *Control of* **HOUSEHOLD INSECTS** *and Related Pests*

BY A. E. MICHELbacher, DEANE P. FURMAN, C. S. DAVIS  
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## **HOW TO USE THIS CIRCULAR**

If you have identified your household pest, look up "What-to-do" section for control measures against the pest (listed alphabetically in this circular).

If you do not know the pest you are dealing with, description and life cycle of the suspected pest may help you identify it. If you cannot identify it, send description or better, a preserved specimen of the pest to the Department of Entomology and Parasitology, University of California, Berkeley or Davis, or to the Department of Entomology, University of California, Riverside or Los Angeles, for identification.

If you buy an insecticide, study the list of ingredients on the label, and check page 6 for precautions as to possible side effects of the ingredients. Before using any insecticides, carefully read instructions on the label. Solutions containing insecticides are sometimes inflammable and should not be applied near open flames of any kind.

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UNIVERSITY OF CALIFORNIA  
DIVISION OF AGRICULTURAL SCIENCES  
California Agricultural Experiment Station—Extension Service

THIS CIRCULAR recommends control measures that can be taken by householders against insects and related pests commonly found in California homes. Wood-boring insects such as termites and the several species of beetles infesting wood are considered structural pests and are not discussed here.

**INSECTS** *and related pests found in the home can be divided into two groups for control purposes:*

#### CHEWING PESTS

These include cockroaches, crickets, carpet beetles, pantry insects, ants, wasps, and the larvae of clothes moths. They destroy articles by eating holes in them, or by chewing and consuming the materials they infest. Therefore, stomach or contact poisons as well as fumigants are used to kill them. Many insecticides—especially the newer ones such as DDT, DDD, methoxychlor, chlordane, dieldrin, lindane and malathion—act both as stomach and contact poisons, and some may also exert some fumigant action.

#### SUCKING PESTS

These include mosquitoes, bedbugs, cone-nosed bugs, fleas, body lice, ticks and certain mites. They feed by inserting their mouthparts through the skin of man or animals and sucking the blood. They are controlled by contact insecticides or fumigants. Some insects such as houseflies have lapping-sucking mouthparts that do not pierce skin, but may contaminate food. This group is controlled largely by contact insecticides, although stomach poisons may be used.

Insects and their relatives—the spiders, mites, ticks, centipedes, scorpions, millipedes and sowbugs—do not always remain in one part of the house, but most of those discussed in this circular are grouped below according to where they will most likely be encountered. Spiders and pests that enter homes by chance (including predaceous and darkling ground beetles, corizid grass bugs, elm leafbeetle, box elder bugs, centipedes, millipedes, sowbugs, and crickets) may be found throughout the house.

#### DRAWINGS AND SIZES

The drawings of the insects shown in the text are for the most part greatly enlarged. The actual size of the insect is often indicated by a line thus:



This line shows the *length*, or body length exclusive of antennae of the insect illustrated.

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**INSECTICIDES** *used in control of household pests are of three types:*

1. Stomach poisons
2. Fumigants
3. Contact poisons

As noted, many of the newer insecticides act both as stomach and contact poisons; some also exert a fumigant action.

**Stomach poisons.**—Sodium fluoride, sodium fluosilicate, and sodium arsenite are strictly stomach poisons. They should be used with extreme caution. Sodium fluoride and sodium fluosilicate are used in poison baits and as dusts, sometimes in combination with other materials for the control of such insects as cockroaches, crickets, and ants. Sodium fluosilicate is also used in the preparation of mothproofing solutions. Sodium arsenite, a very toxic material, is used at low concentrations as the active killing agent in certain commercial ant syrups. *The arsenicals, as well as other insecticides, should always be placed where they are inaccessible to irresponsible persons, children or pets.*

Rotenone, relatively non-poisonous to humans, is primarily a contact insecticide. It has some action as a stomach poison and is effective against a number of household pests. Available in dust and liquid preparations, it is frequently combined with other insecticides.

**Fumigants.** Paradichlorobenzene and naphthalene are both safe and effective for home use. Carbon tetrachloride, or a mixture of 3 parts by volume of ethylene dichloride to 1 part of carbon tetrachloride also is effective and suitable for household use if adequate precautions are taken to *avoid inhalation of vapors.*

Paradichlorobenzene (PDB) is a clear crystalline material. It is used as a fumigant for materials other than food, be-



A plastic catsup dispenser is useful in applying insecticidal dusts under kitchen appliances and cabinets.

cause its odor is readily absorbed. Materials to be fumigated are placed in tight containers (such as trunks, or large cans with lids), and the fumigant crystals are scattered throughout the materials or placed between layers of paper; materials should be subjected to the fumigant vapor for several days at a temperature of not less than 70° F. Longer exposure will do no harm.

Naphthalene is used in the same manner as paradichlorobenzene. It evaporates more slowly than PDB and therefore infested materials require longer exposure to insure good control of insect pests.

The ethylene dichloride-carbon tetrachloride mixture is a liquid which smells like chloroform. It can be used to fumigate foods and household articles, but it imparts a taste to foods having a high fat or protein content; thoroughly air such products after fumigation. Use tight containers and expose products at least 24 hours at 70° F. Avoid breathing the toxic vapors. Carbon tetrachloride is a clear liquid fumigant used in the same manner as when mixed with ethylene dichloride. Where there is hazard of imparting an off-flavor to a product, dry ice (solid carbon dioxide) can be used. (For details see directions as given under pantry beetles on page 27.)

Fumigants, which are too hazardous

for the householder to use, include methyl bromide, hydrocyanic acid, and chloropicrin. *If the use of these dangerous fumigants proves necessary, the work should be done by a licensed pest control operator.*

**Contact insecticides** include nicotine pyrethrum, rotenone, organic thiocyanates, mineral oils, DDT, DDD, methoxychlor, dieldrin, lindane, chlordane, and malathion. They are available in commercial preparations as concentrated liquid emulsions, solutions, wettable powders for sprays, space aerosols, aerosols designed to wet the treated surface, and dusts. Solutions, aerosols, and dusts are usually the most satisfactory for home use.

Preparations containing pyrethrum, rotenone, or organic thiocyanates will kill only those insects actually contacted by the insecticide. None of these materials has an appreciable residual action or leaves a poisonous residue; they are among the safest insecticides for home use. However, they are frequently used in combination with more poisonous materials.

If the active ingredient is in sufficient amounts, insecticides containing DDT, DDD, methoxychlor, chlordane, dieldrin, malathion, or lindane have varying degrees of residual action depending very largely upon the amount applied and



Use of a plastic puff-duster in a cupboard.

the kind of insect against which it is directed.

Combination insecticides contain more than one toxic material in order to improve their effectiveness and to help control most of the pests found in a home. Also available are aerosols containing several insecticides which increase the range of pests that they are effective against. Liquid concentrates may also contain more than one insecticide.

Sorptive dusts kill by removing the wax or oil from an insect's outer water-proof layer; this causes the insect to lose

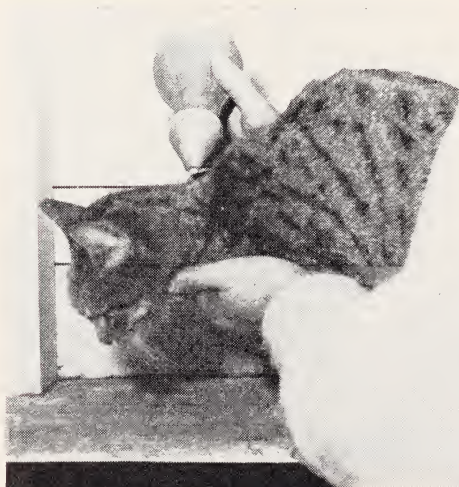
such large quantities of water that it dies. Not all sorptive dusts are equally effective. One of the best is a finely divided, amorphous silica aerogel available commercially under the trade name Dri-Die 67®. In this circular, recommendations for use of sorptive dusts refer only to formulations meeting the specifications of Dri-Die 67®. This silica preparation is impregnated with a small percentage of ammonium fluosilicate which enables it to adhere to most surfaces, and greatly increases its effectiveness. Unless used in relatively large quantities, however, even fluoride-impregnated sorptive dusts may not provide rapid control of insect pests.

Insecticides, dusters, and sprayers can be purchased at hardware stores, feed and fuel stores, seed stores, nurseries, local distributing plants of insecticide companies, and from other sources. Keep sprayers and dusters clean.

Be sure to read the label on the package before purchasing an insecticide; it is a guarantee of the contents. Read instructions very carefully.

*Store insecticides in airtight containers out of the reach of children and under lock and key.*

Rubber bulb or plastic puff-dusters are useful in applying insecticidal dusts to household pets.



*Read these*

## **PRECAUTIONS** *before applying insecticides*

Although there is little danger of serious residue from preparations using pyrethrum, or rotenone, care should be taken to avoid contaminating foods with any insecticides when applied as sprays or dusts. Many household solutions containing insecticides are inflammable and should not be applied near open flames.

When solutions used for residual sprays contain DDT, DDD, methoxychlor, chlordane, dieldrin, malathion, lindane or combination of these materials, the following precautions should be followed:

1. Do not fill the air with spray mist. Apply the solution directly to the surface to be treated. This can best be accomplished by using a coarse spray applied under low pressure or by applying with a brush.
2. Do not wet surfaces to the point where the solution runs off.
3. Do not use on food, around food preparation areas, or on dishes or cooking utensils.
4. Do not empty sprayers containing unused solution where there is danger of waste flowing into children's play areas, fish pools, or similar places.
5. Do not use solutions or oil-based sprays on animals.
6. Be careful when using solutions on highly polished surfaces; some solvents will mar the finish. Highly refined kerosene, one of the most common solvents, may remove polish slightly if allowed to drip on such surfaces.
7. Do not breathe vapors or permit solutions to remain on skin; protect body and bare skin as well as pos-

sible. Do not eat or smoke while applying insecticides. Wash hands and face thoroughly with warm water and soap following each application, as insecticides in oil solution are readily absorbed through the skin. Change clothing if it becomes soaked with spray; bathe, and do not wear the garments again until they have been laundered.

8. Before treating wallpaper and certain fabrics, make certain the solution will not stain or discolor the material.
9. DDT and similar solutions will fog windows, and will leave a residue if sprayed on dark surfaces. Sprays containing chlordane leave no visible residue on dark surfaces.
10. Do not apply household solutions to plants of any kind.

When these insecticides are used as dusts, wettable powders for sprays, or emulsions, follow all the precautions listed above except 5 and 6. In these formulations DDT and related compounds are less injurious to man since they are not as easily absorbed through the skin. However, in working with dusts it is advisable that a respirator or some other protective covering be used to cover the nose and mouth. Little hazard will result from use of the suggested insecticides if used as recommended in this circular.

Aerosols can be used in the home, but only such insects as flies and mosquitoes are easily controlled by them. Insects in protected locations are not killed unless the area is wet by a low-pressure spray bomb. Aerosol bombs designed to wet the surface treated rather than to mist into the air are also available.

## HOUSEHOLD PESTS in California

### ANTS



Size, adult:

H

Argentine Ant, *Iridomyrmex humilis* Mayr

Ant colonies are found nearly everywhere. Some species build their nests in open ground, others under stones or wood, in wood, decaying trees, or in other locations that afford protection. Ants are generally wingless except at mating time. Soon after mating the males die, and the females (queens) lose their wings and attempt to establish new colonies.

Ants may injure lawns, gardens, and orchards by their nesting habits. Some feed on crops, fruit, seeds, and nuts. Others feed on honeydew and protect the aphids, scales or other insects that excrete it. Some species of ants will be attracted into homes by the presence of sweets or fatty substances.

The most annoying household ant in California is the Argentine ant, *Iridomyrmex humilis* Mayr, which has spread over most of the state. Long columns of this pest will invade a kitchen overnight seeking sweets.

Carpenter ants, *Camponotus* species, the largest found in California, measure up to  $\frac{3}{4}$  inch or more in length. They may damage homes by excavating nests in timber, though they do not feed on the wood itself.

Other common household varieties include the odorous house ant, California velvety tree ant, pyramid ant, California

fire ant, western thief ant, Pharaoh's ant, tiny black ant, and the pavement ant.

#### WHAT TO DO:

A number of poisoned ant syrups give excellent control of the Argentine and other sweets-loving ants if properly used.

Chlordane, dieldrin, or combination of these materials with malathion, are very effective, while DDT solutions are less effective. Chlordane solutions should be at least  $2\frac{1}{2}$  per cent; dieldrin should be a 0.5 per cent solution.

*In the house*, apply solutions with sprayer or narrow brush. If you use a brush, apply solution on paths followed by ants. If paths are changed, repeat the operation until the ants disappear.

When spraying, direct spray to wet the paths.

*Do Not* spray near open flames (see page 6 for other precautions).

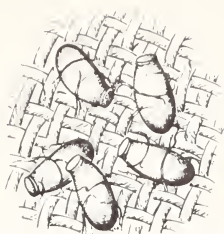
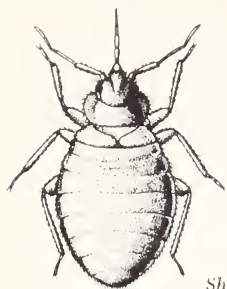
Aerosol bombs designed for wetting a surface and containing lindane, chlordane, or dieldrin, or combination of these insecticides are also effective if used as suggested above.

In experimental and field demonstrational work sorptive dust (page 5) has been found effective in controlling ants within the home. The dust may be applied at the rate of 1 pound per 1,000 square feet of floor space, or preferably restrict treatment to the less conspicuous areas infested, such as in and behind cabinets, drawers, on shelves, along baseboards and ceiling moldings.

*For out-of-doors control*, apply solution or dust to nests around foundations or other infested areas. A coarse spray made of 9 ounces of 40 per cent wettable chlordane powder in 1 gallon of water will result in excellent control.

Carpenter ants in timbers can be controlled by injecting dusts containing chlordane or dieldrin into the burrows.

# BEDBUGS



Shown: dorsal view of adult and eggs attached in fabric

— Size, adult

Bedbug, *Cimex lectularius* Linn.

The common adult bedbug, *Cimex lectularius* Linn., is a wingless, flattened insect, about  $\frac{3}{16}$  inch long and  $\frac{1}{8}$  inch wide. The slender, pointed mouthparts are adapted for piercing skin and sucking blood. The dusty red color of the unfed bug changes with feeding to bright red; the body becomes much thickened.

Infestations of bedbugs are usually accompanied by a disagreeable "buggy" odor. Often, however, the first indication will be the discovery of itching bites in the morning and dark brown stains on bed sheets.

Small oval eggs are laid by adults in their usual hiding places (see below), where they hatch in about a week in warm weather. Young bugs look like the larger adults and have similar feeding habits. They are blood-sucking pests from the moment they are hatched. Bedbugs may survive starvation for several months.

## WHAT TO DO:

Lightly spray a 5 per cent DDT solution in kerosene over the frame and springs of the bed and over both sides and edges of the mattress. Use a coarse droplet spray directly on the objects treated; DO NOT fill the air with a mist. An application of 3 to 4 fluid ounces of spray to a double bed should be sufficient. This solution is inflammable; see page 6 for precautions.

For quicker results, spray hiding

places, such as cracks in floors and walls, behind baseboards and pictures, and overstuffed furniture.

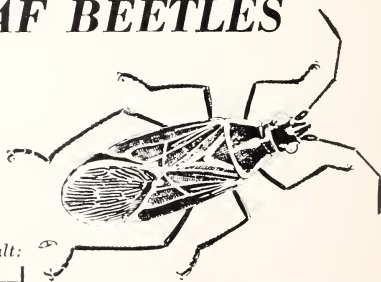
Five per cent emulsions or water suspensions of DDT are effective, but leave an unsightly residue.

A synergized pyrethrum spray solution is also effective; it should contain at least 0.2 per cent of pyrethrins in refined kerosene, plus 1 per cent of a synergist such as piperonyl butoxide, sulfoxide, or n propyl isome. This treatment should be repeated in six weeks.

Insecticidal dust containing 5 per cent DDT may be applied by hand duster. Recent investigations indicate that certain sorptive dusts (page 5) also control bedbugs effectively. Apply a thin film of dust to their hiding places. Dusts are unsightly but a vacuum cleaner will quickly remove excess from conspicuous places. Liquid or dry commercial insecticides can also be used.

Serious infestations may require fumigation with hydrocyanic acid gas which should be done by a licensed pest control operator. This method, which is rarely needed, requires special precautions for human safety.

## BOX ELDER, CORIZID GRASS BUGS, AND ELM LEAF BEETLES



Size, adult:



Box Elder Bug, *Leptocoris trivittatus* (Say)

Box elder bugs, corizid grass bugs, and elm leaf beetles live outdoors but sometimes enter buildings.

Box elder bugs, *Leptocoris trivittatus*

(Say), may invade homes in fall, winter or, occasionally, early summer. They are small, dark bugs, about  $\frac{1}{2}$  inch long with red longitudinal lines on the back; they do no damage, but are a nuisance.

Corizid grass bugs are about  $\frac{1}{4}$  inch long, and usually gray or brown. Individual insects, and occasionally swarms, may enter homes. Normally they do not attack man, but at night they may drop from lights onto a person and probe his skin in search of moisture. No serious effects will be suffered from such attacks.

Elm leaf beetles, *Galerucella xanthomeloena* (Schrank), often invade homes in the fall. They are about  $\frac{1}{4}$  inch long, yellowish or dull green with an indistinct black stripe down the outer side of the wing cover; they cause no damage but can be a nuisance.

#### WHAT TO DO:

Apply a household contact spray directly on the insects. Where box elder bugs are concentrated in large numbers on the trunks of trees, or the shady side of a house or fence apply a spray that contains  $\frac{1}{2}$  per cent dieldrin. This can be made by adding one pint of dieldrin emulsible concentrate to five gallons of water. In order to prevent the insects from entering the house, it is important to wet the foundation right down to the ground, and to spray around outside doors and window sills. A chlordane spray, or malathion in combination with either chlordane or dieldrin, is also effective. For further help on preventing entry see suggestions under predaceous and darkling ground beetles, page 31.

In homes, elm leaf beetles can be controlled by applying DDT sprays or dusts on the insects and hibernating places.

## BROWN DOG TICKS

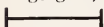
The brown dog tick, *Rhipicephalus sanguineus* (Latr.), about  $\frac{1}{4}$  to almost  $\frac{1}{2}$  inch long, is often found on dogs in Cali-



Size:  
Unengorged female



Engorged female



Brown Dog Tick, *Rhipicephalus sanguineus* (Latr.)

fornia. It concentrates about buildings where dogs are kept rather than in woods or open country. The "head" of the adult tick is six-sided when viewed from above, while that of wood ticks found on dogs is more or less rectangular. If in doubt as to whether wood ticks or brown dog ticks are involved, consult the entomology department of the University of California, state or local health agencies, or your local farm advisor.

The color of the adult tick is reddish brown, changing to a bluish shade in fully-fed females. A female may lay from 1,000 to 3,000 eggs in cracks in the roofs of kennels or in ceilings of buildings, where adult ticks migrate after feeding. Growing ticks feed on dogs but hide in cracks between feeding periods.

#### WHAT TO DO:

Thoroughly wash the dog with a dip made by mixing 2.5 ounces of 25 per cent lindane wettable powder in 10 gallons of water. Wait for at least one week before repeating. Alternatively, a rotenone wash may be made by mixing 2 ounces of 3 to 5 per cent rotenone powder and 1 ounce of neutral soap in 1 gallon of water. Thoroughly wet the animal with the rotenone wash at 3-day intervals until the pests are eliminated. Do not get the insecticides in the animal's eyes. Avoid breathing the rotenone powder while mixing the wash.

A 5% Sevin® dust is effective in controlling brown dog ticks when dusted thoroughly on the dog and around its

sleeping quarters. A 1 per cent lindane emulsion spray or a sorptive dust (page 5) may also be used to treat infested kennels or in the home to control this pest. For use inside the home the lindane preparation should be applied *only* as a spot spray; here it is valuable in controlling localized concentrations of ticks. A 5 per cent DDT solution is less reliable for control of the ticks. Sorptive dust also is safe and effective for general home use; disadvantages are that it is unsightly in exposed places and, unless left in place at least 24 hours, the control value of the dust is lost.

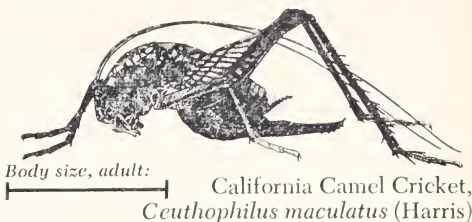
Control of the brown dog tick with DDT, chlordane, dieldrin and malathion may not be effective in some areas because this tick has developed a resistance to these pesticides. Other effective materials are Diazinon® and dimethyl 1, 2-dibromo-2, 2-dichloroethyl phosphate (Dibrom®), but their use is not recommended at present for householders.

Sprays may be applied with an ordinary hand or mechanical sprayer. For applying dusts, use a small hand duster or bellows.

Meticulous application of pesticides is necessary to eradicate the brown dog tick. Pay special attention to the room where the dog sleeps. Since the ticks tend to migrate upward, make certain that the spray, or dust, reaches the ceiling area. Spots requiring special attention include ceiling moldings, cracks, baseboards, and door and window frames. Do not neglect treating the undersides of furniture, floor coverings, and behind pictures and draperies. Bedding of infested dogs should be treated thoroughly, laundered in very hot water, or destroyed. If the dog sleeps in the bedroom, be sure to treat the bed frame and mattress with sorptive dust (see page 5) or a 5 per cent DDT spray.

Where staining of wood is not objectionable, undiluted creosote oil may be applied effectively, particularly in warmer regions where the tick may overwinter out of doors.

## CALIFORNIA CAMEL CRICKET



The California camel cricket is uniformly pale brown with darker chestnut-brown bands across the back. When mature they measure about  $\frac{3}{4}$  inch. The female has a short, saber-like ovipositor at the tip of the body for laying eggs. The insects have very long antennae, and a hind pair of legs well adapted for jumping. Viewed from the side they appear humped, thus the name camel cricket. They are soil-inhabiting insects, and may be found under stones, boards, logs or debris; when found in homes they are usually limited to the ground floor or basement where it is moist. They are harmless and do no damage.

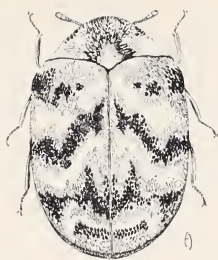
### WHAT TO DO:

Dryness and heat create unfavorable conditions for these crickets. Treating the locations where they occur with a residual type of spray will help keep them under control. The best spray to use is one that contains dieldrin; sprays with DDT, lindane, chlordane, malathion, or combinations of these materials, are also effective.

## CARPET BEETLES

Carpet beetles damage fabrics by eating holes in them and may completely destroy some articles.

Carpet beetles, unlike clothes moths (see p. 14), spin no webbing. Infestations are indicated by the presence of the cast-off, hairy skins of their larvae.

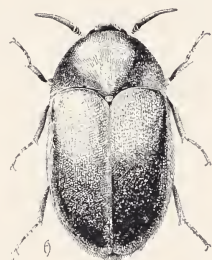
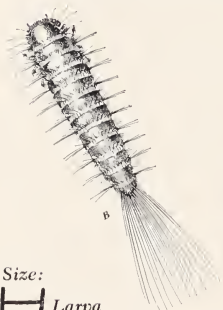


Size:

— Larva

— Adult

Varied Carpet Beetle, *Anthrenus verbasci* (Linn.)



Size:

— Larva  
body length

— Adult

Black Carpet Beetle, *Attagenus piceus* (Oliv.)

All damage is done by the larvae. Larvae of the varied carpet beetle, *Anthrenus verbasci* Linn., and the bird-nest carpet beetle, *Anthrenus lepidus* Lec., are short, robust, and stubby, and have the hairs arranged in a neat pattern. Larvae of the black carpet beetle, *Attagenus piceus* Oliv., are elongate, reddish brown above, pale beneath, and have a tuft of very long hairs at the tail end.

Adult carpet beetles are small, oval, somewhat flattened insects with short legs. The varied and bird-nest carpet beetle adults are about  $\frac{1}{8}$  inch long and are mottled black, brownish, and white. The black carpet beetle adult is about  $\frac{3}{16}$  inch long and is all black.

The adults fly readily and are attracted to daylight so may collect at windows. During their active period in the spring, they gather in large numbers on flowers where they feed on pollen and

nectar. Adult beetles in the home during the spring do not necessarily indicate an infestation, but should alert the homeowner that larvae may be present.

The larvae prefer dark, undisturbed locations and, depending upon the species, such food as unprocessed hair, feathers, wool, fur, dried animal products, pollen, and certain cereal products. Because of this, bird, rodent, and insect nests, and animals' bedding places furnish excellent natural breeding areas.

These natural breeding places are important sources of infestations.

Most household furnishings and clothing subject to attack are less suitable as a food for carpet beetles than are the raw products from which they are made. Some processed goods are such poor food sources that the larvae develop on them with great difficulty, if at all.

Although carpet beetles ordinarily damage material made from animal products, under certain conditions they also attack nylon and dacron fabrics.

#### WHAT TO DO:

Prevent infestation by destroying or removing abandoned nests of birds, rodents, and insects (particularly bees and wasps) situated in or close to the house. The more protected from the elements these nests are, the more likely they are to be infested with larvae. Keep the bedding places of pets clean.

Clear away lint in attics, furnace vents, cracks in the floor, and behind baseboards. Fill cracks in floors and loose-fitting baseboards with plastic material or similar fillers.

Destroy untreated skins, neglected insect collections, discarded woolen rags and clothing.

Vacuum carpets frequently; clean the undersides when possible. Wall-to-wall or tacked down carpeting provide favorable breeding places for larvae.

Occasionally clean and move furniture, rugs, drapes, and other articles sub-

ject to attack. This disturbs locations suitable for carpet beetle development and reduces the possibility of infestation.

Thoroughly brush clothing and other susceptible articles and hang them in the sun on warm bright days.

Whenever possible in furnishing your home, use materials such as cotton.

Watch cereal products for infestation.

#### MEASURES THAT DESTROY AS WELL AS HELP PREVENT INFESTATION:

1. **Contact sprays.** If you find carpet beetles in the house, destroy them immediately. Long lasting protection can be obtained by using a spray containing 5 per cent DDT in highly refined or deodorized kerosene. Dieldrin, chlordane, lindane, or sprays containing malathion in combination with these insecticides also afford residual protection. Sprays containing pyrethrum as the killing agent destroy only insects contacted at the time of treatment.

Contact sprays are best applied with small power sprayers, although mechanical hand sprayers can be used effectively. Be sure to wet hidden breeding places such as loose baseboards and cracks in the floor. Excellent control in such locations can be obtained by applying contact sprays with a paint brush. Also, spray DDT lightly on upholstered furniture and other articles subject to attack, on both sides if possible.

2. **Protective treatments (pest proofing).** Clothing and other materials which are not injured by dry cleaning can be protected from attacks for as long as two years (or until it is dry-cleaned) by wetting with a 5 per cent DDT spray. Apply the spray lightly and uniformly until the surface is moist. Hang treated materials outdoors until dry.

Excellent protection is obtained where DDT content of the treated goods equals  $\frac{1}{4}$  to  $\frac{1}{2}$  per cent of the dry weight of the garments. Deposits greater than  $\frac{3}{4}$  per cent are likely to be visible on dark

clothing. Toxaphene gives good protection, but is also removed by dry cleaning.

Surface-wetting aerosol bombs which contain DDT, chlordane, dieldrin, lindane, malathion, pyrethrins or combinations of these materials, are effective; the benefit derived will depend upon thoroughness of application.

When using commercial products containing fluoride for pest proofing, follow directions given on the container.

Articles which can be thoroughly wetted without being injured can be protected by impregnating with a saturated solution of sodium fluosilicate. Spraying the material will also provide a considerable degree of control. To prepare the solution, place 1 ounce of sodium fluosilicate in 1 gallon of water, shake the mixture several times, and pour off the clear liquid. To this add 1 or 2 tablespoons of a wetting agent and apply as a spray, thoroughly wetting the article. Label solution with a poison sticker and keep out of children's reach.

3. **Dry cleaning.** Dry cleaning kills insects present in articles but does not prevent reinfestation.

4. **Fumigation.** Flake naphthalene or paradichlorobenzene crystals (PDB) can safely be used to fumigate a trunk, closet, or any tight chamber. If the container is not tight, line it with heavy paper and seal with tape. Use 1 pound of fumigant to each 20 cubic feet of chamber space;  $\frac{1}{2}$  pound will treat a good-sized trunk.

Scatter fumigant between the layers of articles to be treated, or between layers of paper separating the articles. Both fumigants are most effective at temperatures of 70° F or higher. Under favorable conditions, 7 days exposure will kill the insects. If the container is reasonably tight, one application a year should insure perfect protection.

In a closet, made fairly tight, apply fumigant to the floor and shelving at the rate of 1 pound to each 20 cubic feet of space. Keep replenishing the supply as it

evaporates. Leave articles in the closet as long as possible, but air them before wearing.

Pests in a closet can also be killed by vaporizing PDB crystals with a vacuum cleaner. A special attachment is available for this purpose.

If piano felts become infested, place 1 to 1½ pounds of paradichlorobenzene in a porous bag inside the piano. Close all openings and cover piano with a tarpaulin for about a week. If possible, the family should be away from the house during this period. After fumigation open and air the piano.

A satisfactory nonflammable liquid fumigant, a mixture of 3 parts by volume of ethylene dichloride and 1 part by volume of carbon tetrachloride, is available under its chemical name or trade names. Carbon tetrachloride can be used alone if the mixture is not obtainable.

The liquid fumigant kills faster than naphthalene or paradichlorobenzene; at 70° F or higher, the insects are killed in 24 hours. Keep fumigation chamber tight and place fumigant in a shallow pan on top of the materials to be treated in ratio of 1½ ounce to 1 cubic foot of chamber space. Open windows and doors when placing or removing fumigant as the vapors of carbon tetrachloride are toxic.

DO NOT attempt to fumigate an entire dwelling; this should be done only by a licensed pest control operator.

**5. Cold storage.** Placing articles in cold storage will kill insects if temperatures of 0° F or lower are maintained for a day or more. A deep freeze can be utilized for this purpose.

**6. Heating.** Insects are killed in about two hours if exposed to a temperature of 120° F. Higher temperatures require shorter exposures, but DO NOT let the temperature rise above 140° F, as the article being treated may be injured.

The insects must be actually subjected to the lethal heat. Because the temperature in their hiding places will rise more

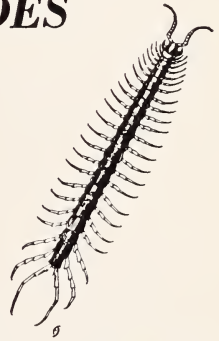
slowly, the air temperature of the room itself should be raised to 125° to 135° F and held there for about 12 hours.

**Protecting rugs.** Infested rugs should be removed, cleaned, and treated to prevent reinfestation. Pull up wall-to-wall carpeting around the edges (of the room) and treat underside and pad with a 5 per cent DDT solution or 0.5 per cent diel-drin solution. After re-laying, lightly spray its upper surface.

For new carpeting, thoroughly clean the floor and spray both sides of the pad as well as the underside of the carpeting. If this is not feasible, spray the floor with DDT or dieldrin, or place a 10 per cent DDT dust on the floor before pad is put down. After the pad is down, spray or dust its upper surface. This should give protection for several years. Treating with a fluoride solution (page 12) gives satisfactory control and protection.

## CENTIPEDES

Size, adult:



Centipede, *Cermatia forceps* (Raf.)

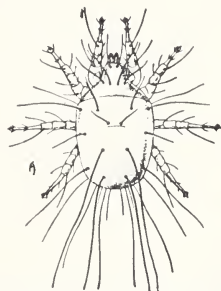
Centipedes are flattened, many-legged, wormlike creatures of rapid movement. They normally live outdoors, but occasionally are found in clothing, beds, shoes, and other dark places. The house centipede is brownish with black stripes on the long legs and three longitudinal black stripes on the upper surface of the body. It usually lives in damp cellars, but may rove throughout the house, and can inflict a painful, but usually not serious bite.

#### WHAT TO DO:

In the home, use sprays containing pyrethrins, 5 per cent DDT or 0.5 per cent lindane solution, or spot treatment with 5 per cent malathion spray. To prevent entry, and to control them outside the home, use sprays containing 0.5 per cent dieldrin or lindane, 2 to 3 per cent chlordane or 5 per cent DDT. Dusts containing 5 to 6 per cent chlordane or 5 per cent DDT may also be used. Treat foundations, joists and subfloor supports of buildings, the ground under the buildings, wall areas immediately around doors, and windows or other openings.

Eliminate accumulations of debris, stacks of lumber, or stored household effects from basements or locations near the house.

## CEREAL MITES



Size: less than 0.5 mm

Cereal Mite, *Tyrophagus putrescentiae* (Shrank)

Cereal mites, *Tyrophagus putrescentiae* (Shrank), are frequently found in enormous numbers in cereal and cereal products, but also on other stored food, particularly cheese and dried meat. The mites are pale-colored, wingless, smooth, soft-bodied, nearly microscopic organism with four pairs of legs.

In large numbers the mites appear as loose, fluffy masses of gray powder. They sometimes swarm from infested materials and may even attack humans handling infested materials, causing a severe skin condition known as "grocer's itch."

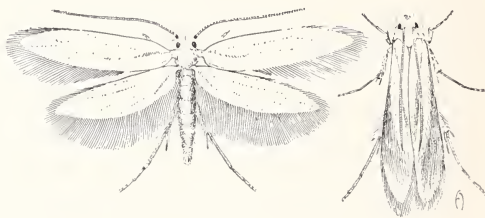
Moist conditions favor their development. Large numbers of mites indicate that the infested product has a higher than desired moisture content.

#### WHAT TO DO:

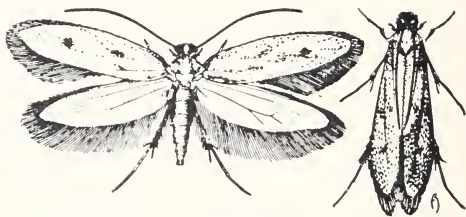
Locate and destroy the infested material. Clean the surroundings and keep them as dry as possible. Heating an infested unit or product at 130° F for several hours will kill cereal and related mites.

To prevent future infestations, keep the storage area dry and follow precautions listed under pantry beetles on page 28.

## CLOTHES MOTHS



Webbing Clothes Moth, *Tineola biselliella* (Hum.)



— Size, adult body length

Casemaking Clothes Moth, *Tinea pellionella* (Linn.)

Clothes moths are most destructive when articles subject to attack are left undisturbed for long periods.

Damage caused by clothes moths can be distinguished from that of carpet beetles by the silk-lined tubes made by the webbing clothes moth, *Tineola biselliella* Hum., and the silken parchment-like cases constructed by the casemaking clothes moth, *Tinea pellionella* Linn. Carpet beetles spin no webbing.

Both moths are small, the adults with wings folded measuring about  $\frac{1}{4}$  inch in length. The adult webbing clothes moth

is buff-colored and has a satiny sheen; hairs on the head are upright, and reddish in color. The casemaking clothes moth is similar, but has indistinct dark spots on the wings, and has lighter-colored hairs on the head.

Clothes moths are not strong fliers. They prefer darkness, but will flit about the margins of lighted areas. When infested fabrics are disturbed, the moths run rapidly or fly to conceal themselves. This ability to disappear is characteristic.

All damage is done by the larvae or caterpillars. Larvae have pearly white bodies, dark heads, and are about  $\frac{3}{8}$  inch long when fully grown. On some foods their bodies may be nearly translucent; on others, they become more opaque and somewhat dingy in color.

The larva of the casemaking clothes moth constructs a silken, parchment-like case; when disturbed it retreats into it. Larvae of the webbing clothes moth live within silken burrows which they construct, and which includes parts of the fabric they are living on.

The natural food of clothes moths consists of unprocessed materials such as pollen, hair, feathers, wool, fur, insect remains, and other dried animal products.

Any accumulations of these materials in cracks in the floor or other protected places are very likely to be infested and furnish reservoirs of infestation.

A new generation of moths may develop in three months to a year in undisturbed breeding sites, with a resulting increase in rate of damage.

#### WHAT TO DO:

Follow the control measures outlined for carpet beetles on pages 11–12. Brush and air all materials. In brushing, pay particular attention to seams, folds, and similar places, as brushing crushes and dislodges eggs.

The pest does not like sunlight; larvae will drop from goods hung in bright sun.

## CLOVER MITES



Size: body length 0.7 mm

Clover Mite, *Bryobia praetiosa* Koch

The common clover mite, *Bryobia praetiosa* Koch, is one of the larger mites, measuring  $\frac{3}{100}$  inch in length. It has relatively long front legs which extend forward and are about as long as the body. It varies in color from dusty brown to dull green. Hordes of these pests may invade California homes at almost any season of the year.

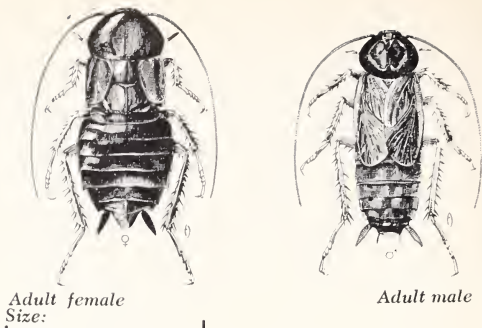
The mite feeds on the leaves of such plants as clover, alfalfa, peas, grasses, and numerous herbs, shrubs, and trees. Infestations can usually be traced to infested plants, particularly grass very close to the house. The clover mite creates a nuisance in the home by its presence and by crawling over the skin of occupants, but it does not bite.

#### WHAT TO DO:

Indoors, spray odorless white kerosene directly on the mites, and into cracks where they may hide. Many commercial household sprays, particularly those containing malathion, will kill the mites upon contact. Aerosol household bombs designed to wet treated surfaces will kill all mites contacted. In severe infestation, repeated applications are necessary.

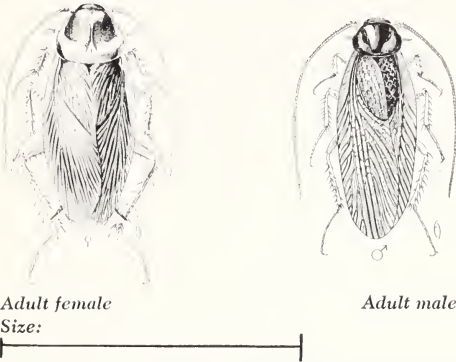
To prevent entry of mites, remove all vegetation, especially grass in contact with the house, to a distance of 12 to 18 inches. Treat the side of the house and surrounding vegetation with a 3 per cent aramite dust, or a spray containing  $\frac{1}{2}$  ounce of 15 per cent wettable powder of

aramite in 1 gallon of water. A sorptive dust (page 5) has been found effective in controlling clover mite infestations out of doors when applied at the rate of 1 to 1½ pounds per 1,000 square feet of lawn area. Under warm conditions dusting with sulfur gives some relief, but tracking sulfur into the home may result in tarnishing of silverware, and sulfur is also very irritating to the eyes.

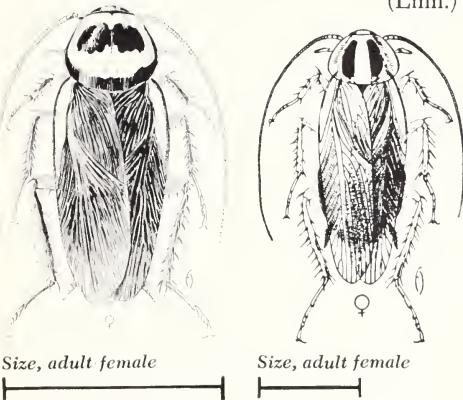


Oriental Cockroach, *Blatta orientalis* (Linn.)

## COCKROACHES



American Cockroach, *Periplaneta americana* (Linn.)



Australian Cockroach, *Periplaneta australasiae* (Fabr.)

German Cockroach, *Blatella germanica* (Linn.)

Cockroaches are flattened, fast-running, nocturnal, insects which are fond of warm, moist areas. They contaminate food and often leave a very unpleasant odor on the materials they infest. General feeders, they will even feed on such

materials as bookbindings and fabrics.

The five species found in California homes are the American cockroach, *Periplaneta americana* (Linn.) (1½ to 2 inches long, reddish-brown wings completely covering the abdomen), the Australian cockroach, *P. australasiae* (Fabr.) (1 to 1½ inches long, yellow streak on the outer edge of wings), the German cockroach, *Blatella germanica* (Linn.) (½ inch long, light brown, two darker longitudinal stripes on the shield covering its head), the brown-banded cockroach, *Supella supellectilium* (Serv.) (¾ to 1½ inch long, pale brown, with two paler crossbands on the wings) and the oriental cockroach, *Blatta orientalis* (Linn.) (1¼ inches long, black to brownish, male with short wings, adult female nearly wingless).

In heavily cockroach-infested houses where food is readily available and it is warm and humid, cockroaches will be found at almost any hour of the day. In lightly and moderately infested homes cockroaches generally will be found only during the late evening and early morning hours.

Cockroaches lay their eggs in leathery capsules, called oöthecae, which are frequently seen protruding from the abdomen of females. These capsules are eventually dropped or attached to some object. Newly hatched cockroaches are very small, but resemble adults sufficiently to be recognizable.



Left to right, American, Oriental, brown-banded, and German cockroaches. Slightly enlarged.

#### WHAT TO DO:

*Good housekeeping* is the key to cockroach control; insecticides alone give only temporary relief. Therefore, before using any insecticide, clean all areas thoroughly so that no food particles, debris, dust and clutter remain to foster cockroach infestation.

Keep all food—cereals, crackers, meats, vegetables, flour, condiments, etc.—tightly covered or in a refrigerator at all times between uses. Pay particular attention to cat, dog and other pet foods—cockroaches can subsist on these alone. Return all excess pet food to its container, close tightly or put in refrigerator; keep feeding dish thoroughly washed out; sweep up immediately all food dropped on the floor.

Keep garbage and waste containers covered. If uncovered, they should be completely emptied into covered container every night, and emptied frequently during the day. Keep waste bins covered at all times; keep unused or in-

frequently used incinerators closed or covered, and seal all cracks and crevices in the brick, concrete or masonry.

In heavily infested establishments, eliminate—at least until the cockroaches are under control—all possible hiding places such as flags, pictures, ceramic wall decorations, calendars, penants, antimacassars, dresser and table scarves, piano and couch throws, decorative pillows, scatter rugs and draperies. Before rehanging, or before treatment if they cannot be left off during treatment, all items should be laundered or dry-cleaned. Infested materials in closets, cupboards, and drawers should be cleaned and the drawers or closets wiped clean before treatment and replacement of the cleaned items. Dispose of all stored magazines, newspapers and accumulated items. All decorative bric-a-brac and collections around which cockroaches have been found should be washed or cleaned, and stored temporarily until a fair measure of control is obtained.



Egg cases of cockroaches. Left to right, Oriental cockroach, American cockroach, German cockroach, and brown banded cockroach. Shown 4 times actual size.

Empty boxes containing bulbs, seeds, grains, fertilizers, etc. Thoroughly dry bulbs and seeds before storing them in wooden or metal containers.

Reduce breeding areas by repairing and sealing all cracks and crevices in walls, floors and ceilings. It is particularly important to seal all openings around pipes, between window sills and walls, around loose door and window frames, along baseboards and ceiling moldings, around electrical outlets, etc.

Before applying insecticides, completely empty all cupboards, drawers, closets, chests, stoves, etc.; remove even the lining paper. Take from the cabinets all drawers, chopping and bread boards, and flour, sugar and vegetable bins, to avoid contamination with insecticide and to facilitate treating. Remove all food, dishes, pans, utensils, etc. from the cupboards and place them in another room; cover them if they must remain in the area being treated.

#### INSECTICIDES:

Once these preparations have been made you may use a number of insecticides:

*Sorptive dust* (page 5). Limited infes-

tations may be spot-treated with sorptive dust. For control of widespread infestations the recommended rate of  $\frac{3}{4}$  to 1 pound of the dust per 1,000 square feet of total floor area is sufficient for dusting all shelves; cabinets; cupboards; baseboards; moldings; and areas under, around and behind appliances, furniture, wall hangings, fuse boxes, electrical wall outlets, electrical switches and fixtures, floor furnaces, door frames and hinges. Apply the insecticide at the same rate for dusting attics, subfloor areas, basements, etc.

Leave the dust in cabinets, under stoves, refrigerators, and other appliances, in the attic, walls and sub-floor spaces. In drawers and on shelves where eating utensils and food will not become contaminated cover dust by a single sheet of shelf paper. In conspicuous places leave dust for several days, or until the infestation in these areas has been drastically reduced. Dust accidentally dampened need not be replaced.

*Sprays.* Limited infestations may be spot-treated with a 3 per cent malathion spray; avoid contamination of food or cooking utensils. Two to 3 per cent chlor-dane, 0.5 per cent dieldrin, and 5 per

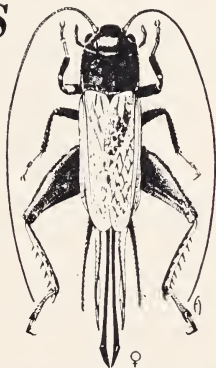
cent DDT sprays, have provided good control of cockroaches in the past, but in many areas cockroaches have developed a resistance to them. Diazinon is effective as a 0.5 per cent spray, but its use is usually restricted to pest control operators.

*Powdered sodium fluoride* is useful in controlling cockroaches, but its poisonous nature necessitates a great deal of caution. Its effectiveness is increased when used in combination with pyrethrum; the most effective preparation contains 75 per cent sodium fluoride and 25 per cent pyrethrum of 0.6 to 0.9 per cent pyrethrin content.

Sodium fluosilicate is sometimes used instead of sodium fluoride since it is less poisonous. However, follow carefully directions given on the container when using any of these materials. Bait pellets are effective, though often rather slow in controlling infestations.

To prevent future infestations, examine carefully all supplies, containers, and other materials brought into the house. Kill every cockroach seen.

## CRICKETS



Size, adult:



Common Field Cricket, *Acheta assimilis* (Fabr.)

The common field crickets, *Acheta assimilis* (Fabr.), are large, brown to black, swift-moving insects with long feelers. They breed outdoors but sometimes migrate into houses, where they feed on fabrics, particularly those soiled or food-stained; they are attracted to lights and may collect in large numbers.

## WHAT TO DO:

Apply dusts containing 2 per cent chlordane, 0.5 per cent dieldrin or a sorptive dust (page 5), or sprays that contain chlordane, dieldrin, pyrethrum, malathion, or combinations of these materials, to hiding places and to floors along the baseboards. Household aerosol bombs of the type designed for wetting the treated surface, or household spray materials that contain a combination of some of the above insecticides, can also be used effectively. If a dust is used and there is no danger of contaminating food-stuffs, blow it into cracks and other hiding places; apply it across door sills and along foundations to kill many of the pests before they enter the house.

Pyrethrum-sodium fluoride or pyrethrum-sodium fluosilicate are also effective, but must be used with great caution.

Where crickets are extremely abundant, poison baits or applications of sprays or dusts containing 10 per cent chlordane or 0.5 per cent dieldrin or granular heptachlor may be used outside the home to destroy the pests. These materials should be scattered about the foundation of the house and throughout the garden.

## FLEAS



Size, adult:



Flea, *Nosopsyllus fasciatus* (Bosc.)

Adult fleas are small, dark reddish-brown insects with legs well developed for jumping. The flea not only causes itching and swelling by its bite, but some species act as carriers of plague, endemic typhus, tularemia, or other diseases and parasites of man.

Fleas commonly found on dogs, cats, and house rodents, will frequently feed on man, particularly if the pets or ro-

dents have been removed from the premises. Man is often attacked by the human flea, *Pulex irritans* Linn., an elusive pest which can cause extreme annoyance by biting repeatedly during a short period of time.

Many people seem to develop a certain tolerance to flea bites when continually exposed to them. However, present control methods are so effective that there is little excuse for flea-infested homes or public gathering places.

#### WHAT TO DO:

On humans, dogs, and most animals except cats, apply a 10 per cent DDT in pyrophyllite dust. One to 2 teaspoons of dust is sufficient for an individual.

In areas where fleas are resistant to DDT, use one of the insecticides given below:

A 1 per cent lindane dust may be applied lightly to the back and neck of dogs. Malathion may be applied to both dogs and cats as a 4 per cent dust, or as a heavy spray made by mixing 1 ounce of the commercial 57 per cent emulsion concentrate in one gallon of water. Flea powders containing pyrethrum or rotenone will quickly rid dogs and cats of most of their fleas, but some will survive, so collect them for disposal by combing the animal over paper 15 minutes after treatment.

A sorptive dust (page 5) or a 5% Sevin<sup>®</sup> dust is also effective. Use  $\frac{1}{3}$  to  $\frac{2}{3}$  ounce per animal, depending on its size and coat. Carefully work the dust into the hair or fur over the entire body. See illustrations, page 5.

Treat pets repeatedly if they roam freely or come in contact with other infested animals. Where flea infestation is moderate and man is not attacked, only the animal may need to be treated. Otherwise, include treatment of your home, animal quarters, and yards. Fleas take about three weeks or more to develop from eggs. During this time the immature stages feed on animal debris. This

explains why you may have a heavy flea infestation although your pet has left weeks ago. Concentrate treatments on places the pet has occupied.

In treating animal quarters, apply insecticide to wall cracks, floors and sub-floor areas of shelters. Flea eggs, which are small, rounded, and white, are usually found on floor, bedding, or similar locations. Treat or destroy bedding. Thoroughly treat dog runs, working the insecticide well into graveled areas, by raking if necessary. Four per cent malathion dust, or a sorptive dust (page 00), are effective; dust into all crevices of the housing. On dog runs apply with a large hand duster at the rate of 1 pound per 1,000 square feet. A spray of 2 per cent malathion emulsion is also useful.

To control fleas in the home, spray with a household preparation containing at least 2 per cent malathion emulsion or 0.5 per cent lindane. Moisten surfaces visibly, using a spray nozzle producing a coarse droplet spray and holding the nozzle a few inches from the surface. Thoroughly spray basements. Treat upholstery, rugs, and all places which might offer refuge to fleas, but make certain by tests that the spray will not stain delicate fabrics.

Insecticidal dusts are effective in the home, but will result in temporary unsightliness. One of the most promising is the silica-gel-ammonium fluosilicate sorptive dust (page 5). You may leave it indefinitely in inconspicuous areas but it should remain at least 24 hours in all infested areas.

Animals often have access to areas under houses and porches and are the cause of heavy flea infestations. In exceptional cases, lawns and yard areas also become flea ridden. Treat these sites with one of the following dusts at the rate of 1 pound per 1,000 square feet of surface: 4 per cent malathion, 1 per cent lindane, or sorptive dust (page 5).

Fleas in many areas have developed a

resistance to insecticides such as DDT and chlordane, and in some places even to malathion and lindane. Sorptive dusts alone or in combination with various insecticides, as well as Sevin® show much future promise for control of resistant flea strains. Resistant fleas also may be controlled by scattering flaked naphthalene over the floors of infested rooms—about 5 pounds per room—and sealing the rooms for 1 to 2 days. Sweep up remaining naphthalene flakes and store them in a tight container for future use.

## FLIES



Common size,  
adult:



Common Housefly, *Musca domestica* Linn.



Common size,  
adult:



Stable Fly, *Stomoxys calcitrans* (Linn.)

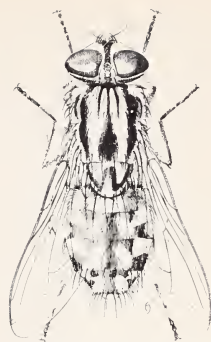


Common size,  
adult:



Black Blowfly, *Phormia* Sp.

The common housefly, *Musca domestica* (Linn.), is more than a nuisance. With



Fleshfly, *Sarcophagid*



Common  
size, adult:



Vinegar Fly, *Drosophila melanogaster* Meigen

its ability to reproduce rapidly and to move quickly from filthy surroundings to the food of man, it can be a carrier of such diseases as typhoid fever, and bacillary and amoebic dysentery.

In 30 days a single fly may lay more than 2,000 eggs in excrement, in garbage, kitchen refuse, stacked lawn clippings, and other decomposing plant and animal matter. In warm weather the egg may hatch in less than 2 days, producing a white maggot or larva. In warm or protected environments, fly reproduction may continue throughout the year.

In cities, housefly infestations usually can be traced to their breeding source within the distance of a city block. However, these pests may fly or be transported by wind for several miles.

In addition to the grayish-black housefly, you may find in your home several other kinds of flies. These are controlled in the same manner as the housefly, although control of their maggots varies.

The stable fly, *Stomoxys calcitrans* (Linn.), which resembles the true house-

fly, has a slender pointed beak with which it can pierce the skin and draw blood. Normally an outdoor fly which feeds on domesticated animals, it tends to enter houses in rainy weather or in the autumn.

To control its maggots, dispose of stable manure or urine-soaked straw daily, as well as moist decaying vegetation such as lawn clippings or plant masses cast upon shores or beaches.

The lesser housefly, *Fannia canicularis* (Linn.), and the latrine fly, *Fannia scalaris* (Fabr.), are characteristically seen flying back and forth in the middle of a room. They seldom light on human food and are therefore less apt to contaminate food than the true housefly, which they resemble. Maggots of these species develop from eggs laid in well-decayed, semi-liquid vegetable matter or in excrement.

The false stable fly, *Muscina stabulans* (Fallen), larger and stouter than the true housefly, has a general dark gray appearance. It cannot bite, but may enter houses and lay its eggs on foods, particularly those that are slightly spoiled.

Blowflies are somewhat larger than the common housefly, and several of them (such as the black blowfly, *Phormia*; the bluebottle, *Calliphora*; and the greenbottles, *Lucilia* and *Phaenicia*) are characterized by brilliant metallic colors. These flies make a much louder droning buzz than do true houseflies, and will lay eggs on exposed meat, resulting in what is known as "flyblown flesh."

Fleshflies (sarcophagids) look like overgrown houseflies; the more common ones have a checkerboard pattern on the abdomen. They deposit living maggots—rather than eggs—in decaying flesh and excrement, especially dog stools.

Vinegar or *Drosophila* fly, *Drosophila melanogaster* Meigen, is a small light brown or orange yellow fly about  $\frac{1}{8}$  inch long. Under favorable conditions it passes through a life cycle in a week to 10 days. The adults are strongly attracted to fer-

menting substances and prefer to lay their eggs in moist breaks in the skin of ripe fruit. The fly reaches maximum numbers in late summer or fall. Enormous populations develop in discarded fruit and other waste. In autumn they frequently swarm into houses and surrounding areas, particularly if any fermenting materials are present; adults are sometimes attracted to freshly painted surfaces. To keep the pest out, destroy fermenting and spoiling fruit, fruit waste, fruit peelings, etc. Keep ripe fruit or melons with broken skins in a refrigerator. Replace corks in beverage bottles and rinse beverage glasses as soon as possible.

#### WHAT TO DO:

For immediate knockdown of flies, use a space or contact spray directly into the air of the room; these sprays are of little residual value if sprayed on walls or windows. For application of space sprays, use a 1 pint to 2 quart hand sprayer supplied with a nozzle producing very fine droplets.

Aerosol bombs are also convenient to use, but have little residual effect on flies entering the premises after treatment.

Where insecticide resistant flies have not become a problem, DDT or methoxychlor solutions may be applied, as given below, to window sills or inside walls. Relatively long-lasting killing effectiveness against flies may be obtained by spraying residual insecticides on outer walls where flies are observed to rest, around window and door frames, and on door screens, ceilings, light fixtures, walls of porches and patios, and around garbage cans and out-buildings.

Apply residual insecticides with a coarse droplet spray at a rate of 1 gallon to 1000 square feet for emulsions or solutions. Where suspensions are used, 1 gallon will cover about 500 square feet. Solutions containing contact insecticides are inflammable and toxic to plants; see page 6 for precautions.

The following formulations are sug-

gested for use as residual insecticides outside the home: emulsion or solution sprays of 1 to 2 per cent malathion, (or 5 per cent malathion for spot treatment); 1 per cent ronnel (Korlan®); 0.6 per cent dieldrin; 0.5 per cent lindane; 2 per cent chlordane; 5 per cent DDT or methoxychlor. Suspension sprays of the same insecticides may also be used. Diazinon® as a 1½ to 1 per cent spray, or Dibrom® as a 0.6 per cent spray, are good outside residual sprays, but use is normally restricted to pest control operators.

Remember that the use of chemicals is not a substitute for good sanitary methods.

In neighborhoods where flies are traceable to widespread breeding areas, community action may be necessary to enforce control.

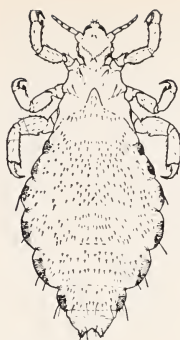
Since the life cycle of flies may be completed in a week to 10 days, all breeding sites should be treated or disposed of weekly during warm weather. Where there is no regular garbage collection, dump waste into a pit and spray with a larvicide, such as a 1 per cent ronnel (Korlan®) or Diazinon® whenever fresh manure is added. Fresh manure spread daily in thin layers in fields as a fertilizer will seldom be a source of fly breeding.

Agencies from which advice may be sought include county farm advisors and local and state public health departments.

## LICE

Man may be infested by three different kinds of lice: the head louse, the body louse or cootie, and the crab louse. All three thrive in crowded, unsanitary living conditions, and cause much irritation to the persons attacked. Additionally, the body louse is an important means of transmitting such diseases as epidemic typhus, relapsing fever, and trench fever.

The head louse is a biological strain of *Pediculus humanus* which spends its entire life on the hairy part of the human



Body Louse  
*Pediculus humanus*  
(Linn.)

Size, adult body louse: H  
Size, adult crab louse: H



Crab Louse  
*Pthirus pubis*  
(Linn.)

head. It is a flattened insect, whitish to blue-gray in color (depending on how recently it has fed), and up to 1/8 inch long. It derives food by sucking blood.

The body louse looks like the head louse, but lives mainly on clothing near the body. The eggs are fastened to clothing, usually under seams. The young lice need food within a day after hatching.

The crab louse, *Pthirus pubis* (Linn.), also known as the pubic louse, is a short, broad insect about 1/5 inch long with thickened, crab-like legs. Characteristically, it lives in the pubic region and armpits, but may be found on any hairy portion of the body—even the eyebrows. Eggs are fastened to body hairs. The pubic lice are spread primarily by promiscuous sexual intercourse.

### WHAT TO DO:

Use a 10 per cent DDT powder to control these pests. If lice are DDT resistant, use one of alternatives suggested below.

For head lice, dust a teaspoonful of the powder thoroughly into the hair. One treatment should be sufficient if the hair is not washed for 10 days. Otherwise, a second treatment will be necessary to kill lice which will have hatched from eggs in the hair.

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*Be sure to read precautions, page 6,  
before applying any insecticides.*

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The NBIN spray used by the U. S. armed forces is a good treatment for head lice. It contains, in parts by weight, benzyl benzoate-68, DDT-6, benzocaine-12, Tween 80-14. This stock is diluted with 5 volumes of water; spray on the hair to moisten rather than wet, keeping out of the eyes. Do not wash hair for at least 24 hours after treatment.

A 3 per cent rotenone powder may be applied as a dust or a wash. Rotenone should be washed off the morning following treatment. Do not get it into the eyes, as it will cause swelling and irritation. Prepare the wash by mixing 2½ tablespoonfuls of rotenone powder and 1 tablespoonful of neutral soap in 1 pint of warm water. This treatment will not kill louse eggs; therefore, two applications should be given within an 8 to 10 day interval.

Lauryl thiocyanate, pyrethrum, and larkspur solution are fairly effective agents and are frequently used in commercial mixtures. Vinegar will loosen eggs attached to hairs, and eggs can then be removed with a fine-toothed comb.

*Body lice* require treatment of the infested person and his clothing. Dust a 10 per cent DDT powder in the hair and thoroughly into the clothing, particularly the seams. Bathe before treatment, but not for 24 hours afterwards. As an alternative to bathing you may use the NBIN formula mentioned above as a light spray for the hairy parts of the body.

Body lice can also be killed by bathing with a kerosene soap emulsion prepared with 2 parts of kerosene to 1 part of soap chips and 4 parts water; work up a lather on body and let it remain for 15 minutes. A 1 per cent lindane dust may be applied as an alternative method, following the procedure given for DDT.

Also effective is a 3 per cent rotenone powder dusted lightly over the body at intervals for 3 weeks; observe precautions listed under head lice. Other effective materials include mixtures of naphthalene, creosote, sulfur, and iodoform.

Infested clothing and bedding should be dusted with 10 per cent DDT or treated by one of the following methods:

Wash with a 5 per cent cresol solution in water or soak for 30 minutes in 2 per cent cresol at 100° F.

Bake materials such as leather, felt, and rubber at 140° F for 20 minutes. DO NOT treat woollens in this manner.

Soak cotton and similar materials in water at 150° F for 5 minutes.

Storage of clothing for three weeks normally eliminates any lice present. Fumigation of clothing is not recommended for use in ordinary households.

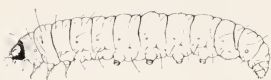
*Pubic lice* should be treated with DDT powder as described above under head lice, with special attention to the pubic region and armpits; the NBIN mixture mentioned will also control the infestation if sprayed lightly on these areas. An effective ointment contains 1 part by volume of 5 per cent rotenone to 10 parts petrolatum. *Mercurial ointment is not recommended* because of its poisonous nature.

## MEAL MOTHS

Flour and meal moths are pantry pests which complete their immature stages of development in the food they infest. The larvae are pale in color and ½ inch long when fully grown. Adults with wings folded are about ¼ inch long.

The two most common species found in the home are the Indian meal moth, *Plodia interpunctella* (Hbn.), and the Mediterranean flour moth, *Anagasta kuhniella* (Zell.). All damage is done by the larvae, which attack a wide range of products, including cereal and cereal products, chicken mash and similar foods, dried fruits, dehydrated vegetables, nuts, chocolate, candies, and various other confections.

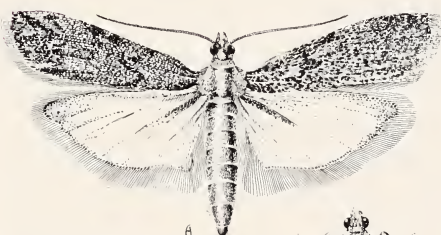
The larvae spin webbing over and through materials they infest, a characteristic which distinguishes their damage



Body size, adult: 

Larva: 

Indian Meal Moth, *Plodia interpunctella* (Hbn.)



Body size, adult: 

Larva: 

Mediterranean Flour Moth, *Anagasta kuhniella* (Zell.)

from that of pantry beetles. Upon completing their development the larvae usually leave the foodstuffs and spin silken cocoons near by.

When infestations are heavy, mature larvae of the moths are often found in parts of the house far from the original food source.

The larvae of both species are very similar and are sparsely covered with rather long hairs. The Mediterranean flour moth larva has black spots at the base of the hairs (particularly those along back and sides) which are absent in the Indian meal moth.

The adult Mediterranean flour moth is slightly larger than the Indian meal moth. Its forewings are lead gray, speckled with black or with transverse wavy black lines, and hind wings are of a uniform, lighter gray color.

The outer two thirds of the forewings of the adult Indian meal moth are coppery brown, while the basal third is pale gray. The hind wings lack distinctive markings and are more or less uniformly gray.

#### WHAT TO DO:

Follow control measures suggested for pantry beetles on pages 28-30.

## MILLIPEDES



Common size: 

Millipede

Millipedes are slow-moving, shiny, worm-like creatures with many pairs of legs. They are usually found in damp places rich in decaying organic matter, and are seldom very destructive unless present in large numbers.

Under certain conditions millipedes enter homes or crawl up the sides of houses.

#### WHAT TO DO:

Apply a residual contact insecticide containing dieldrin or lindane, or these materials in combination with malathion, around the foundations of the house and infested areas. Seal all cracks and openings through which the pest may enter the house. Screen ground-level window openings. Remove rubbish and other accumulations near the foundations. Keep vines and shrubs from growing over windows or other openings.

# MOSQUITOES



Mosquito, *Culex peus* Speiser

Mosquitoes are not only annoying, but may carry encephalomyelitis, malaria, dengue fever, and numerous other serious diseases.

They lay their eggs singly or in rafts on the surface of water, or in depressions which may later contain water. The emerging larva (wriggler) lives and develops only in water.

## WHAT TO DO:

If you live in one of the many mosquito abatement districts in California, report any undue numbers of mosquitoes to the district office, which has trained personnel and equipment for locating and treating the source of breeding. Other agencies from which advice may be obtained include the Entomology and Parasitology Department of the University of California, local farm advisors, and local and state health departments.

**Control.** For immediate control indoors, close infested rooms and mist-spray the air with a kerosene solution containing knockdown agents such as pyrethrins, or Lethane 384 plus killing agents such as DDT. You can also use aerosol bombs which emit the insecticide in the form of a mist. Such sprays or aerosols kill only mosquitoes present in the room at the time of treatment.

For a residual spray, use a 5 per cent solution of DDT in refined white kerosene. Apply this directly to all the inner walls of the house and to the underside of tables and other furniture. Apply as a coarse spray in sufficient amount to wet the surface but without runoff of excess liquid.

DDT and methoxychlor are the only materials recommended for widespread use as residual sprays against mosquitoes in the home; of these DDT is preferable. Such sprays are inflammable; see page 6 for precautions.

Residual sprays may be applied outside the home on walls and ceilings of porches, on door screens, around doors and windows, on foundations of buildings, on tree trunks, and in outbuildings. The deposits will kill mosquitoes resting on the treated surfaces, and may retain their effectiveness for several weeks. Residual spray solutions or emulsions of the following types are suggested: 0.5 per cent Diazinon® or dieldrin; 1 per cent lindane; 2 per cent chlordane; 5 per cent DDT. Use about  $1\frac{1}{3}$  gallons of spray for 1,000 square feet of surface treated. If vegetation is sprayed, use only suspensions prepared from wettable powders of the insecticides; suggested insecticides are 1 per cent lindane,  $2\frac{1}{2}$  per cent DDT or chlordane. See directions on the label for mixing. Because of their high concentration, use sprays of this nature with great caution in treating vegetation; there is some danger of plant injury, and a real possibility that treatments may cause an increase in pest populations of plants.

For temporary but quick relief from mosquitoes outdoors, use pyrethrum or allethrin insecticides applied by an aerosol bomb, or hand or power sprayers producing a fine mist. Direct spray so that it drifts through vegetation.

**Repellents.** A few drops of mosquito repellent rubbed over exposed skin surfaces will usually provide protection from bites for 2 or more hours. Dimethyl phthalate, 612, and Indalone are quite effective, alone or as mixtures. Diethyltoluamide, available commercially under a variety of trade names, is very effective. Oil of citronella is relatively ineffective.

**To prevent mosquito breeding:** Empty all water containers. Keep water from

collecting under buildings; check leaking water pipes and drains. Treat open water containers used for fire protection with 5 per cent DDT, preferably in emulsion form, or add crude cresylic acid diluted 1 to 9 with water until the water has a milky color.

Water containers can also be treated with phenothiazine. Mix 2 ounces of phenothiazine with 1 ounce of a commercial detergent such as used for dish washing. One teaspoonful of this mixture will treat 50 gallons of water.

Garden pools, unless stocked with fish, may require weekly treatment with a larvicide to prevent mosquito breeding. DO NOT apply DDT to water containing fish; even small amounts are harmful. Pools containing plants or fish may be treated with a light spray of pyrethrum oil solution applied at a rate of not over 1 ounce of a stock material containing 0.02 per cent pyrethrins per 100 square feet of water surface. Repetition of treatment at one to two week intervals in warm weather may be needed.

Cesspools and septic tanks may also serve as breeding areas. All openings to these tanks should be tightly screened. The tops should be tightly constructed and adequately covered with soil. Pending other corrective measures, the tanks or ponds can be treated weekly by spraying lightly with a solution of 5 per cent DDT in light oil.

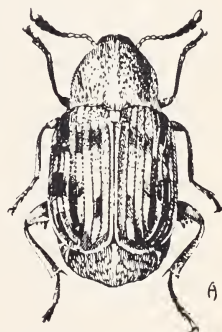
If water stands for over a week in warm weather (as little as five days in some areas), it may produce many mosquitoes. Temporary control may be obtained by spraying with 1 per cent solutions or emulsions of DDT, methoxychlor, chlordane, malathion or toxaphene, or a 0.5 per cent spray of lindane; use 1 ounce of these sprays for each 100 square feet of surface. Kerosene or diesel oil spread on the water surface will also kill mosquito larvae. Where mosquitoes have developed a resistance to chlorinated hydrocarbon insecticides, such as DDT, one of the following materials may

be substituted as a larvicide: Diazinon®, ronnel (=Korlan®), malathion, Pyroicide®, Co-Ral®, DDVP.

Mosquitoes will breed by the thousands in tree holes containing from a cupful to a gallon or more of water. Such holes should be permanently filled and given a cement cap. Unless heavy rains occur, breeding also may be controlled for two months or more by a light spraying weekly with 5 per cent DDT in kerosene, or by applying a heavy residual spray of 5 per cent DDT emulsion. Cresylic acid painted in the holes will usually control breeding for an entire season.

In areas plagued with mosquitoes, doors and windows should be screened with screen of 16 or more meshes to the inch.

## PANTRY BEETLES



Size

Bean Weevil, *Acanthoscelides obtectus* (Say)



Size:

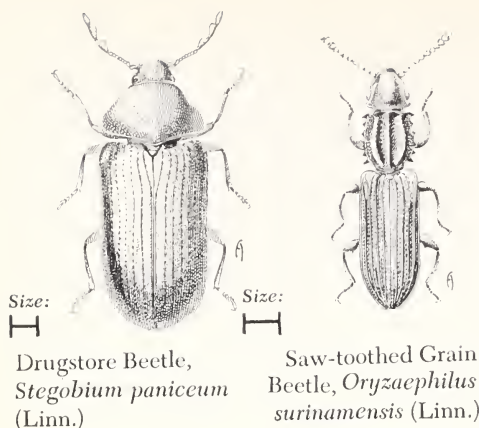
Granary Weevil,  
*Sitophilus granarius*  
(Linn.)



Size:

Confused Flour Beetle,  
*Tribolium confusum*  
Duv.

Small beetles found in and near stored foodstuffs may be one of several species



which can be grouped as pantry beetles. Control will differ according to their feeding habits—whether they are general feeders or restricted feeders.

*Restricted feeders*, such as the bean weevil, *Acanthoscelides obtectus* (Say), the granary weevil, *Sitophilus granarius* (Linn.), and the rice weevil, *Sitophilus oryzae* (Linn.), feed primarily on seeds. Eggs are laid on the seeds, the larvae bore inside to complete their development, and holes are cut out by the emerging adult beetle. Left unchecked, breeding will continue until all of the seeds are destroyed.

The adult bean weevil, about  $\frac{1}{8}$  inch long, is chunky or squarish and the head has a short broad beak. It is velvety gray or brown with pale longitudinal or linear black and white markings. It attacks only beans, peas, and certain other legume seeds. The larvae are legless, grublike, and pale.

The granary weevil and the rice weevil are similar in form and habits. Primarily pests of whole grains, they attack caked cereals such as spaghetti and macaroni. Adults are about  $\frac{1}{8}$  inch long, brown to chestnut brown, cylindrical, and hard-shelled with a long slender snout. The larvae are legless and pale, with dark heads.

*General feeders* attack a wide variety of foods, including grain and cereal products, dried fruit, nuts, spices, drugs,

confections, dehydrated vegetables, dried dog foods, fish foods, other animal food, and dried and cured animal products.

The three most important species found in the home are the confused flour beetle, *Tribolium confusum* Duv., the saw-toothed grain beetle, *Oryzaephilus surinamensis* (Linn.), and the drugstore beetle, *Stegobium paniceum* (Linn.).

Confused flour beetle adults, about  $\frac{1}{8}$  inch long, smooth, and reddish brown, lay eggs in the product they infest. Larvae are somewhat cylindrical, yellowish brown, with a dark head and a pair of slender, pointed growths at the tail end. The pest is most commonly found in cereal and cereal products, but may infest most other stored food materials.

Adult saw-toothed grain beetles are about  $\frac{1}{8}$  inch long, slender, flattened, slightly roughened with a dull, hard, dark brown shell and a row of sawlike tooth projections along either side of the body section behind head. Its diet includes cereals and cereal products, nuts, dried fruits, dried milk and certain animal feeds.

The adult drugstore beetle is brown, cylindrical, about  $\frac{1}{10}$  inch long, and has fairly long antennae or feelers. Its larvae attack a wide assortment of materials, including the coarser cereal products, pet foods, drugs, and spices. Adults, which fly readily, may also enter a home in old furniture, rugs, bedding, or other products of plant or animal origin.

#### WHAT TO DO:

If the infestation is discovered before the pest starts to migrate, or if the beetle is one of the restricted feeders, you need only to get rid of the infested product. It is important to examine all exposed foodstuffs and destroy them if there is the slightest indication of an infestation. (Material of great value may be fumigated, subjected to heat or placed in a deep freeze as described below.)

Thoroughly clean the shelves and floor in the vicinity, and place all infestable

products in containers with tight-fitting lids. For several weeks, purchase cereals, dried fruits, and similar products in small quantities which can be quickly consumed.

Other methods of control include:

1. **Cooling and heating.** Both cold and heat will control pests. Insect activity ceases at temperatures of 40° to 50° F. Two or three days of exposure at 40° F will kill most food insects which attack stored products, and the most resistant are killed within three weeks if placed in a deep freeze.

All stages of insect life in stored products can be killed by exposure to temperatures of 120° to 130° F for two hours. However, the insect itself must be subjected to the heat for the required time, so make certain that the proper temperature is reached and maintained at the center of the treated products. To insure rapid heat penetration, spread the material in as thin a layer as possible and stir from time to time.

Small quantities can be sterilized in an oven; in many cases the desired temperature can be obtained by merely turning up the pilot light in a gas oven, though a longer exposure may be necessary to gain the necessary penetration of heat. A temperature of 130° F will cause a rapid kill.

Insects infesting dried fruits can be killed by dropping the fruit in boiling water for about a minute. Spread the fruit to dry before storing.

2. **Contact sprays** need not be used against these pests unless there has been serious infestation. DO NOT use DDT sprays or those containing lindane, chlordane, dieldrin or malathion; they have a residual action and should never be used on food, around food preparation areas, or on food utensils.

Pyrethrum sprays or those containing malathion can be used to treat bins or bulk-food containers, as they have no marked residual qualities and kill only those insects contacted. Clean the storage

area thoroughly before spraying and allow the units to dry and air out before restoring foodstuffs.

Contact sprays are best applied with a power sprayer, although excellent results can be obtained with hand sprayers. DO NOT spray near fires or flames of any kind; see other precautions on page 6. Aerosol household bombs designed for wetting the treated surface can also be used; where these contain DDT, dieldrin, chlordane or related materials, observe the precautions given for residual sprays.

3. **Contact Dusts.** To control migrating beetles dust food storage areas with sorptive dust (page 5) at the same dosage rate and in the same manner as suggested for controlling cockroaches with this compound. As a rule, drawers, inside cupboards, etc., are all that need be dusted. The dust probably may be left indefinitely in most places where it has been applied, but should be covered with a single sheet of shelf paper. Let dust remain for at least 24 hours before removing it.

4. **Fumigation** for the control of pantry insects is seldom necessary, unless relatively large amounts of food are stored and become infested.

The most satisfactory fumigant for household use is a mixture of 3 parts by volume of ethylene dichloride and 1 part carbon tetrachloride. This colorless, non-inflammable liquid is available to a limited extent under several trade names as well as under its chemical name. More readily available—and nearly as good—is carbon tetrachloride.

Place the products to be fumigated in a container as airtight as possible, such as a new garbage can. Pour fumigant into a shallow pan on top of the product to be treated, place the lid on the can immediately, and seal with tape. Following fumigation, pour remaining fumigant into the original container.

The amount of fumigant used depends on the size of the can or fumigation

chamber; use at a rate of  $\frac{1}{2}$  ounce per cubic foot. This will be about  $\frac{1}{4}$  cup for a medium-sized garbage can.

Fumigation should be conducted at a temperature of 70° F or higher; after an exposure of 24 to 36 hours, remove the product, air it, and place it in tight containers. Air particularly well treated foods of high protein content or of medium to high fat content, such as nuts, beans, rice polishings, wheat germ, and soybeans.

Store unused fumigant in a cool, dry place out of reach of children.

*Fumigation by dry ice* (solid carbon dioxide) can be used to treat and preserve walnut and other nut meats.

**CAUTION:** Do not handle dry ice with bare hands—it will freeze the skin quickly.

*Do not seal the jars until all dry ice has disappeared.*

One cubic inch of dry ice will make 12 to 14 quarts of carbon dioxide gas. If you sealed a quart jar full of walnut kernels with a cubic inch of dry ice inside, you would have a bomb with between 200 and 250 pounds pressure per square inch when the dry ice turned to gas. Of course, the jar would explode.

To fumigate by dry ice:

Crack out the walnut kernels. Be sure they are fully dried; the drier they are the better their quality after storage.

Put a single layer of kernels in the bottom of the jars.

Cut 1-inch cubes of dry ice; a common wood saw can be used. A 5-pound dry ice slab, 10" × 10" × 1", will make 100 pieces.

Put a dry ice cube on the layer of walnuts a short distance from the side of the jar, and where you can see it after jar is filled. (Jars may crack if the dry ice is against the glass.)

Fill with kernels. A quart jar will hold 12 to 14 ounces.

Put on the lids and screw them down until they begin to tighten, then turn them back until slightly loose. Lids must

be loose to allow the air and excess gas to escape. *Remember that bomb!!*

Allow jars to stand undisturbed until all dry ice is gone.

Screw lids down tightly.

Store in as cool a place as possible.

That's all there is to it. Use about  $\frac{1}{2}$  cubic inch of dry ice for pint jars, 1 cubic inch for 1-quart jars, 2 cubic inches for 2-quart jars.

Various sizes of air-tight tin cans can be used. Fill and put in dry ice as for jars. Use 1 cubic inch of dry ice for each quart capacity. Punch a  $\frac{1}{16}$  inch hole in the lid. Put in the dry ice. Fill with kernels and seal the lid in place. After an hour or so, put a drop of water over the hole. If gas is still coming out, bubbles will show. When bubbling stops, seal the hole with tape.

This method of using dry ice is also suitable for preserving other types of stored products.

**To prevent future pantry beetle infestations:**

Do not leave food in open containers on shelves; place them in containers with tight-fitting lids, or destroy them.

Clean, and keep clean, shelves and bins and all other locations where food materials could accumulate, even in small amounts.

Do not mix old and new food materials. Infested old material may quickly infest the new.

Clean old containers before filling them with fresh materials.

Do not purchase broken or damaged packages of food materials, as they may be infested.

Construct storage units so that they are tight and can be cleaned easily.

Store bulk materials, such as pet foods, in containers with tight-fitting lids.

Keep storage units dry. **THIS IS IMPORTANT.** Moisture favors the development of pantry pests; dryness discourages them.

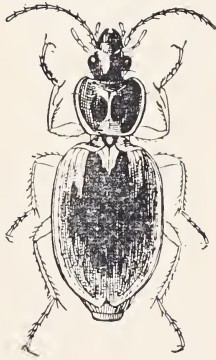
Many pantry insects breed in rodent and insect nests and may migrate from

these into homes. Dumps and areas where by-products and wastes from processing plants are deposited afford excellent breeding places.

Opened food products which are set aside and forgotten are almost certain to become infested. Once the product has been wholly or partially consumed, the insects disperse and—if general feeders—may soon infest every suitable material in the house.

Most home infestations result from introduction of some infested product. Most food product packages are relatively insect-tight and, unless the products were infested when originally packed, they should remain free of pests.

## PREDACEOUS AND DARKLING GROUND BEETLES



Size, adult:



Predaceous Ground Beetle,  
*Platynus maculicollis* (Dej.)

Among the insects that live outdoors but accidentally enter homes while seeking places to spend inactive periods are the predaceous ground beetles and the darkling ground beetles. These do no harm in the home although some species emit a very offensive odor.

Predaceous ground beetles are somber brown or black, medium-sized, move rather rapidly, and feed on other insects. One of the most troublesome of the species is the tule beetle, which is about

$\frac{1}{2}$  inch long, pale brown in color with a large, dark blotch occupying much of the wing covers. It breeds in the marsh lands along rivers and often appears in large swarms at dusk following rains in the fall. It emits an offensive odor when disturbed.

Darkling ground beetles are small, hard-shelled, black, slow-moving beetles which feed on living and decayed vegetable matter.

Among insects which may be confused with predaceous and darkling ground beetles are wood-boring beetles which emerge from holes in infested firewood. These insects may congregate in large numbers on windows, but will do no harm.

Homes located under oak trees may be invaded by tiny, grub-like weevil larvae which develop inside acorns and drop to the ground to pupate. If they land on a roof, they may crawl into the dwelling. Birds may cache infested acorns about a house, and the grubs that emerge from these may also be encountered.

### WHAT TO DO:

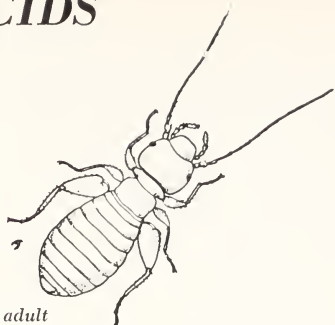
If only a few insects are involved, kill them with a fly swatter. Larger numbers may be controlled with contact sprays or dusts by treating infested areas. Contact spray solutions are inflammable; see page 6 for precautions.

To prevent entry of the beetles, seal all openings and crevices in the outer walls of the house, particularly the cracks between doors and doorjambs. Make sure screens are tight. Eliminate all rubbish and other accumulations about the foundation.

Keep the outside of the house dry and prevent shrubbery from growing over windows or other openings.

Do not confuse the relatively harmless beetles with the damaging carpet beetles and pantry beetles which may “swarm” in various parts of the house. Control methods for these different types of beetles are not the same.

## PSOCIDS



H Body size, adult

Cereal Psocid, *Liposcelis divinatorius* (Mull.)

Psocids (booklice) are minute, soft-bodied, flattened insects. Those found in the house are wingless and light to dark in color. Usually they are not harmful, but become annoying when in large numbers. You may recognize them by their jerky manner of running.

Warmth and dampness favor psocids, and they are most likely to be found in dark, damp rooms or among damp vegetable products such as straw mattresses, certain upholstered furniture, wallpaper, and pantry supplies. Their food appears to be mostly microscopic molds; they may damage bookbindings and other starchy materials.

### WHAT TO DO:

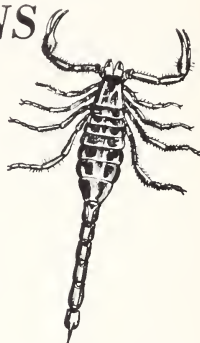
Spray where psocids are found with a 5 per cent DDT or methoxychlor spray or with a pyrethrin spray, alone or in combination with one of the other insecticides. DO NOT use such a spray near flames of any kind; see page 6 for precautions. Aerosol household bombs designed for wetting the surface treated are also effective against the pest.

Dry out the areas where psocids are found. See that the environment is well ventilated and exposed to as much light as possible.

Heating houses during periods of favorable temperature conditions in the summer will help. Raise the temperature to 125 degrees F and maintain it for at least 12 hours.

Destroy infested materials if of little value. Otherwise, thoroughly dry them, or fumigate them in the manner described on pages 4 and 5.

## SCORPIONS



Size: 2 to 3 inches

Scorpion, *Hadrurus hirsutus* (Wood)

Scorpions are easily distinguished by their crablike appearance and long, fleshy, segmented tail ending in an enlarged tip bearing a stinger. The stinger is normally used to paralyze the insects and spiders upon which the scorpions feed.

The sting of most scorpions is quite painful, but no more to be feared than the sting of a wasp. Dangerously venomous types of scorpions are not known to occur in California.

Scorpions found in California measure from less than 1 inch to over 3 inches in length. They usually move about at night, hiding during the day under floors, boards, and debris, or the bark of trees.

### WHAT TO DO:

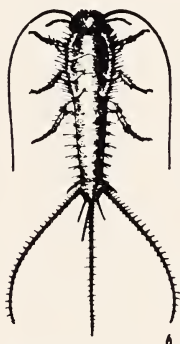
In the home treat baseboards, moldings, under sinks, and around cracks and corners. Outside the house treat foundations, joists and subfloor supports of buildings, as well as the ground under the structures. Treat rough out-buildings, such as privies and garages. Use spray solutions or emulsions containing any of the following: 5 per cent deodorized malathion, 0.5 per cent lindane, or 0.5 per cent dieldrin. Dusts containing 1 per

cent dieldrin or 1 per cent lindane are effective. Clear creosote may also be sprayed on outside structures with good results.

Eliminate accumulations of debris, stacks of lumber, or stored household effects from basements or places adjacent to the house. These serve as hiding places for the pest.

If you live in an area where scorpions are abundant, shake clothing and inspect shoes before dressing.

## SILVERFISH AND FIREBRATS



Size, adult:

Silverfish, *Ctenolepisma urbana* Stabaugh



Size, adult:

Firebrat, *Thermobia domestica* (Pack.)

Silverfish, *Lepisma saccharina* Linn., and fire brat, *Thermobia domestica* (Pack.), are long, wingless, scaly insects about  $\frac{3}{8}$  inch in length. They are nocturnal, fast runners recognizable by the pair of long antennae on the head and 3 prominent filaments protruding from the tail end.

Silverfish, which are silvery-gray, prefer warm, damp places, but may be found in almost any part of a building. Firebrats, which are mottled with dark spots, usually stay in heated basements or similar locations.

Both insects can live for long periods without feeding. The silverfish eats

mostly vegetable matter, preferably of a high starch or sugar content.

The insects become very destructive under favorable conditions by feeding on the sizing in paper, bookbindings, wall-paper, or any other materials where glue or starch are present. Fabrics of plant origin are attacked in varying degrees. Thin starched materials, linen, and rayon goods may be seriously damaged, and lisle and cotton fabrics are also fed upon. Clean fabrics of animal origin are usually avoided.

### WHAT TO DO:

Apply a 5 per cent solution of DDT in highly refined kerosene or a household solution containing chlordane, dieldrin, DDT, methoxychlor, lindane, malathion, pyrethrins or combinations of these materials as a coarse spray, on infested surfaces. These include the back walls of shelvings, baseboards, closets, dead spaces under sinks, and holes where pipes pass through floors or walls. DO NOT use spray near fires or flames of any kind; see page 6 for other precautions. Aerosol household bombs designed for wetting the surface treated can also be effectively used.

A sorptive dust (page 5) may be applied in place of the sprays at the rate of 1 pound per 1,000 square feet of floor area. You can obtain good control by dusting the attic and subfloor area or basement. A 10 per cent DDT dust also may be used for attic or basement treatment.

To prevent breeding of the pests, dry out the warm, damp, secluded locations that foster their development.

### CAUTION

Be sure to handle poisonous material carefully. See page 6 for suggestions that will help you to avoid trouble.

## SPRINGTAILS

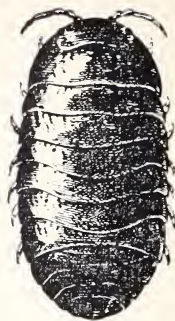


Size, adult:

H

Springtail

## SOWBUGS AND PILLBUGS



Size. |

Shown: pillbug in retracted and extended positions

Pillbug, *Armadillidium vulgare* (Lat.)

Springtails are variably colored insects, about  $\frac{1}{16}$  inch long. They get their name from the fact that they jump when disturbed. The adults of those found indoors are most likely to be bluish or grayish.

Normally, springtails live out of doors where their food consists largely of decaying organic materials, although germinating seeds and roots of plants are sometimes seriously attacked.

As household pests, springtails are limited to areas in the home that are moist, such as the soil of potted plants, or in locations into which moisture has penetrated. Dense vegetation, or vines, growing near or against a house may create an environment favorable for the pest to enter it, particularly if these conditions exist about windows or other openings. Springtails are most likely to enter a home during the damp cool portions of the year.

### WHAT TO DO:

Maintaining dryness in a home is the best means of keeping out springtails. Repair water leaks, and prune vines and shrubs covering windows, doors, porches and similar places.

Springtails can be killed with contact sprays, and those containing dieldrin, lindane, chlordane or pyrethrins are especially effective. Treating around foundations will discourage springtails from entering the house.

These organisms are dark or slate in color with flattened, segmented bodies and 7 pairs of legs. They breathe by means of gills, and will die if removed from moist conditions. Therefore, they live in damp earth and leaf mold, and rapidly disappear during hot weather if their habitat thoroughly dries out.

Although sowbugs and pillbugs will feed on a wide range of materials, their diet consists chiefly of decaying vegetable matter. They will occasionally attack living vegetation and are particularly injurious to seedlings.

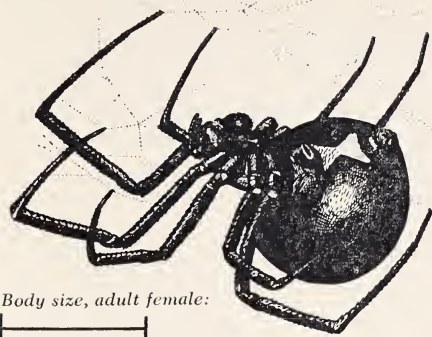
They sometimes become household pests when they congregate in large numbers in a moist basement.

### WHAT TO DO:

Apply a contact insecticide containing dieldrin, chlordane, lindane, malathion, or a combination of some of these, directly on the pests and on areas they frequent. Seal all cracks and openings, especially around windows and doors, through which they may enter the house. Contact sprays are inflammable; see page 6 for precautions.

Remove rubbish and other accumulations about the foundations. Prevent shrubbery from growing over windows and other openings. Keep the outside of the house dry.

# SPIDERS



Black Widow Spider, *Latrodectus mactans* (Fabr.)

Spiders may be distinguished easily from insects in that they have four pairs of legs instead of three and do not have antennae or feelers. The only spider in California dangerously poisonous to man is the black widow, *Latrodectus mactans* (Fabr.) Bites from other spiders are not uncommon, but the effects are localized and rarely as severe as a bee sting. Most spiders found around the house do more good than harm by killing insects.

The adult female black widow, sometimes called the shoe-button spider, has a rounded, glossy black body; there is usually an orange or red marking resembling an hourglass on the underside of the body. The shape of the mark is not constant, however, and some spiders may have more than one mark. With legs extended, the female measures up to 2 inches in length. The male is much smaller and has stripes of white and pale brown along the sides of the abdomen.

The loose irregular web constructed by the black widow is found in protected, dark corners in homes, garages, basements, under eaves and around outhouses, and under piles of wood or rubbish. Its silken strands are quite coarse in comparison with those of other house spiders.

The *Pholcus* spider, encountered in basements, closets, and other dark places, spins irregular, loose webs which are

often mistaken for those of the black widow. However, the web is of much finer silk. This spider has an elongate body with very long legs, and has a habit of violently shaking its web.

Trapdoor spiders are rather large and are often mistaken for young tarantulas. They build tunnels in the ground and cap them with lids of soil and silk. They are often found wandering in homes following the start of the rainy season.

The spiders commonly called tarantulas in California are found most abundantly in the southern part of the state. Large, hairy, ferocious-looking, but practically harmless to man, they are only accidental visitors in a house.

Also harmless are spiders of the orb weaver group, which spin symmetrical rounded webs in gardens. Many other innocuous species of spiders invade houses, but normally can be controlled by good housekeeping methods. In the case of unusual infestations, the following control methods suggested for the black widow may be used.

## WHAT TO DO:

For black widow spiders, treat garages, basements, attics, and outhouses with a residual spray of lindane or dieldrin. Wet the walls and webbing with spray along beams, in cracks and corners, and under shelves or similar protected sites which are most frequented by the spiders. Spray solutions in oil are inflammable; see page 6 for precautions.

The spray will kill spiders contacted and will continue up to several months to kill spiders visiting the treated surfaces. The following spray formulations are effective:

0.2 to 0.5 per cent lindane, 0.5 per cent dieldrin, or 2 to 3 per cent chlordane. Five per cent malathion spray may be used as a spot treatment. If vegetation is to be treated, sprays should be prepared as suspensions from wettable powders in accordance with instructions given on the commercial labels.

Creosote has also been used successfully on the wood of outhouses to kill spiders and repel future invaders.

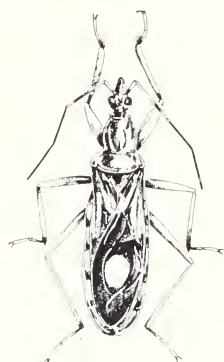
To prevent entry of spiders, tightly screen doors, windows, and other openings of the house from basement to attic. Destroy weeds, rubbish, and dead grass in the yard, and clear away rocks, tin cans, and other debris which might provide shelter.

## CONE-NOSED BUGS



Size, adult.

Triatoma



Size, adult:

Western Spotted Corsair,  
*Rasahus thoracicus* Stal.

*Triatoma* bugs (known also as China bedbugs, cone-nose bugs, or kissing bugs) live exclusively on the blood of animals, including man. They frequently attack humans at night. Some people are sensitive to their bites, and may experience intense itching, nausea, flushed face, palpitation of the heart, rapid breathing and pulse, and hives.

The adult bugs vary from very light to dark brown and are from  $\frac{3}{4}$  to  $1\frac{1}{2}$  inches long. They have a long, narrow head with a slender, piercing beak which is bent beneath the head when not in use. The wings are folded back over the body and overlap at their tips, leaving a triangular area between the bases. The immature bugs do not have wings and are considerably smaller.

The pests live in the nests of wood rats (*Neotoma*, pack rats, etc.), but also invade the beds of human beings. In California they sometimes are found flying to lights, and at such times they may fly into houses. Residents of foothill areas of central and southern California are most often troubled by these pests.

These bugs have been found naturally infested with the microscopic parasite causing Chagas disease in man, but no human cases have been reported to date in California.

A rather similar appearing insect included with the cone-nosed bugs is the western spotted corsair, *Rasahus thoracicus* Stal. Its feeding habits are quite different from the *Triatoma* bugs, however, as it feeds on other insects. It is frequently attracted to lights in warm areas of California and, if picked up or handled carelessly by man may inflict a painful bite; the effects of the bite are at least as severe as those of a bee sting.

### WHAT TO DO:

Spray directly with a standard fly spray or an aerosol bomb to kill insect present.

Residual lindane sprays prepared as described for fly control (pages 22, 23) will provide several months' protection when applied to interior walls and floors. The material is safe to use, though the slight, lingering odor is offensive to some persons.

There is no specific treatment for the bite of these bugs. Warm compresses of magnesium sulfate applied to the bite are recommended. If the symptoms are severe, call a doctor.

To prevent invasions by *Triatoma* bugs, screen your house and make it insect-proof. Remove wood rat nests from around dwellings, especially from underneath them. Wood rats often nest in piles of cactus pads or mesquite in desert regions, or in piles of sticks in forested areas.

# TROPICAL RAT MITES



Size: less than 0.5 mm

Tropical Rat Mite, *Ornithonyssus bacoti* (Hirst)

The tropical rat mite, *Ornithonyssus bacoti* (Hirst), is most frequently encountered in California homes after the rat on which it lived has left the premises or died. The hungry mites may swarm over the walls and furniture seeking a blood meal. Only  $\frac{1}{100}$  inch long, they can be best seen after feeding, when their normal gray-brown color is overshadowed by the red of ingested blood in their swollen bodies. Their bites cause an inflammation of the skin, known as "rat-bite dermatitis," and are usually accompanied by intense itching. There may be watery blisters or a slight to moderate swelling.

In children particularly, the effects of the bites are noticeable, and scratching creates the danger of subsequent bacterial infection. The mite may transmit endemic typhus to man.

## WHAT TO DO:

Eliminate rats from the house. However, even then tropical rat mites may be a problem.

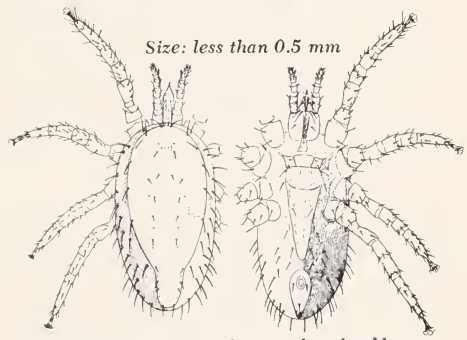
Treat attics, sub-floor areas, cracks, crevices, furnace vents, baseboards, bed-frames, mattresses, etc. with a sorptive dust (page 5) at the rate of  $\frac{3}{4}$  to 1 pound per 1,000 square feet of floor area. In attics and sub-floor areas apply the dust with an electric duster, or large hand or rotary duster; inside living areas, dust may be applied with a hand duster.

In conspicuous areas, the dust should be left for at least 24 hours, before removing. In inconspicuous places the dust should be left indefinitely.

Other useful control measures include spraying infested areas thoroughly with highly refined kerosene containing lethane. A thorough spraying with refined kerosene alone will kill those mites contacted, as will wiping furniture with a rag soaked in refined kerosene. Such use of kerosene constitutes a fire hazard; see page 6 for precautions.

Various other commercial household spray preparations, such as 0.5 per cent lindane or a pyrethrum solution in refined kerosene, are effective. Spot treatment with 2 per cent malathion spray is also recommended.

# BIRD MITES AND CHICKEN TICKS



Shown: half-drawings of top and undersides

Tropical Fowl Mite, *Ornithonyssus sylviarum* Can. & Fanzago

The tropical fowl mite, *Ornithonyssus sylviarum* (Can. and Fanzago), and the common poultry mite, *Dermanyssus gallinae* (DeGeer) are common parasites of poultry in California. The former pest is also common in nests of wild birds, and when nests are built against homes the mite inhabitants occasionally wander into the houses, especially after the nestlings have left. Furniture, patios, bamboo shades, etc. often become infested with the mites.

## WHAT TO DO:

Only a specialist can distinguish these mites from the tropical rat mite, and while the insecticides used against the latter pest will also kill bird mites, removal or treatment of the source of infestation is very different. Bird nests should be removed from under eaves or other places of contact with the house, preferably after the young have been reared, and the infested areas sprayed with insecticide. Two per cent malathion spray will give rapid control, but the other insecticides listed for tropical rat mite control are also effective here.

If bird nests are considered desirable from an aesthetic viewpoint they may be dusted with a 4 per cent deodorized malathion dust without harming the birds. A sorptive dust (page 5) may be used similarly, both on nests and on other infested areas.

Chicken ticks, *Argas persicus* (Oken), are associated with poultry and, occasionally, wild birds. They are flattened, leathery and rounded pests measuring up to  $\frac{1}{2}$  inch long. They feed only on blood but are able to survive for several months without feeding, hiding in cracks in the housing, under bark of trees or in similar sites; if found in a home, the source will usually be found to be roosting or nesting birds. Removal of birds and treatment of the sites with 2 to 5 per cent malathion spray will control the pest. A deodorized spray of 1.5 to 2 per cent may be applied to cracks in walls, floors or on other protected places where ticks may be hiding.

## WASPS AND YELLOW JACKETS

There are several kinds of wasps that at times are very annoying to man: yellow jackets or hornets, such as the *Vespula* species, *Polistes* wasps, and mud-dauber



Mud Dauber Wasp



Yellow Jacket, *Vespula pennsylvanica* (Saussure)

or thread-waisted wasps such as *Sphex* and *Pelopaeus* species.

Apart from what annoyance they cause and what fruit they may eat, yellow jackets are beneficial because they destroy enormous numbers of insects. They construct large paper nests from fibers; some yellow jackets build nests above the ground, others construct them in the soil. Control measures described below vary according to the location of the nest.

Yellow jacket nests are started in the spring by the queen which is the only individual to survive the winter; workers take over the building and feeding duties and the nest rapidly increases in size. After new queens and males are produced and leave the nest, in the summer and fall, the old queen dies and the nest declines.

Workers left in nests built above

ground always die before the advent of cold weather, and the nests are often deserted by mid-summer; those that nest in the soil may live on into the winter. This is a factor to be remembered in choosing control measures.

Adult yellow jackets feed only on liquids, principally energy-yielding foods such as nectar, honeydew, juice (and pulp) of ripe fruit, and manufactured sweets. The larvae are fed animal materials which are first chewed and conditioned by the workers.

*Polistes* wasps normally do not attack man. Their life history and habits are very similar to those of yellow jackets, except that their colonies are much smaller and their open-faced, paper nests are not enclosed in envelopes.

Mud-dauber or thread-waisted wasps, which construct individual nests of mud, are solitary wasps that seldom attack man and can be distinguished from other wasps by the long narrow waist between the thorax and abdomen.

#### WHAT TO DO:

For yellow jackets which build their nests above the ground no control measures are necessary after mid-summer or shortly thereafter.

If the nuisance occurs before then, spray the entrance to the nest with a contact spray such as 2.5 per cent chlordane, 0.5 per cent dieldrin, 5 per cent DDT solution, or one that contains lindane, DDD, methoxychlor, malathion, pyrethrins or a combination of some of these materials. Such sprays are inflammable; see page 6 for precautions. Aerosol bombs containing these materials can also be utilized. To reduce the danger of being stung, spray in the evening or early morning when most of the wasps are in the nest; direct the spray toward the opening of the nest. Any early morning wasps that fly out will be in-

capacitated as soon as they strike the droplets. The nest readily absorbs spray, so apply enough material to thoroughly wet it. It can be removed the following day.

Effective control can also be obtained by thoroughly dusting the entrance to the nest with 5 per cent chlordane, or 10 per cent DDT dust, or one that contains dieldrin or lindane.

Yellow jacket nests found in the soil should be treated at night by pouring 1 to several ounces of carbon disulfide into the entrance and covering with several shovelfuls of soil. Carbon disulfide is very inflammable and explosive when mixed with air. Keep it away from flames and sparks of all kinds, and use with great caution. DO NOT store it in the house.

Dieldrin or chlordane solutions are also very effective when poured into the nests.

A 10 per cent DDT dust, or one containing chlordane, dieldrin or lindane, is also effective against ground nests. Apply the dust after dark with a small hand duster. Approach the nest cautiously, but get close enough to direct the dust into the opening.

*Polistes* wasps are easily controlled by spraying the nest after dark with a good contact insecticide, or by dusting it with a 10 per cent DDT dust. If found hibernating in the house, kill wasps with a flyswatter; they can also be killed by spraying the locations they frequent with a 5 per cent DDT solution. DO NOT use such a spray near flames of any kind; see page 6 for other precautions.

Because there is only a single adult wasp to contend with in controlling the mud-dauber or thread-waisted wasp, kill it with a flyswatter or a contact spray and destroy the nest. In winter destroy the mud nests to eliminate the overwintering forms.

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# TOO MANY INSECTS . . . NOT ENOUGH INSECT-FIGHTERS



Students and instructor watch spray demonstration on Oxford Tract, Berkeley

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